Gated Pub No 16

# WATER-COOLED TRANSMITTING TUBES

AND

# CERTAIN AIR-COOLED TUBES USED IN TRANSMITTING EQUIPMENT

TECHNICAL SERIES
TT-2

RCA RADIOTRON COMPANY, INC.
Harrison, New Jersey

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The Tube Collectors Association is a nonprofit, noncommercial group of individuals active in the use, history, and preservation of electron-tube technology.

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# 846

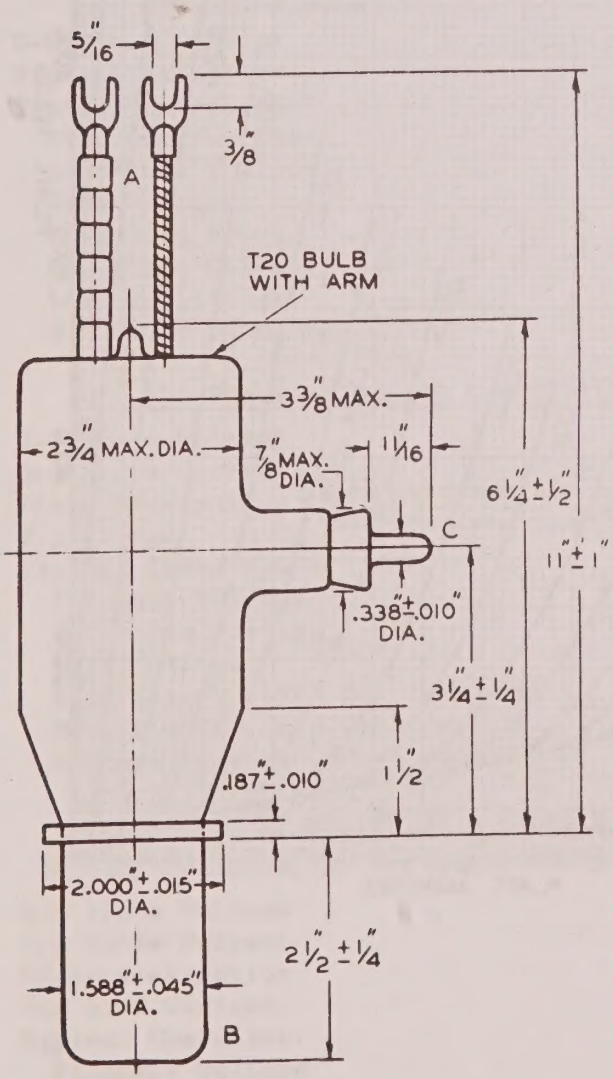
# OSCILLATOR, R-F POWER AMPLIFIER

(continued from preceding page)

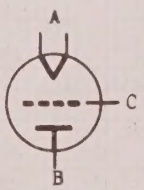
| | | |
|---|---|---|
| D-C Grid Current | 0.15 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 6750 | volts |
| Grid Voltage | -200 approx. | volts |
| Nominal Power Output | 3600 | watts |

**NOTE:** Regardless of the type of service in which the 846 is used, the maximum ratings apply only for single-tube operation at frequencies below 50 megacycles ( wavelengths above 6 meters). For operation at higher frequencies, refer to TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY in front part of HANDBOOK.

When two or more 846's are used in parallel, the plate voltage and output should be reduced. The amount of reduction depends on the number of tubes paralleled as well as the type of circuit and service contemplated.

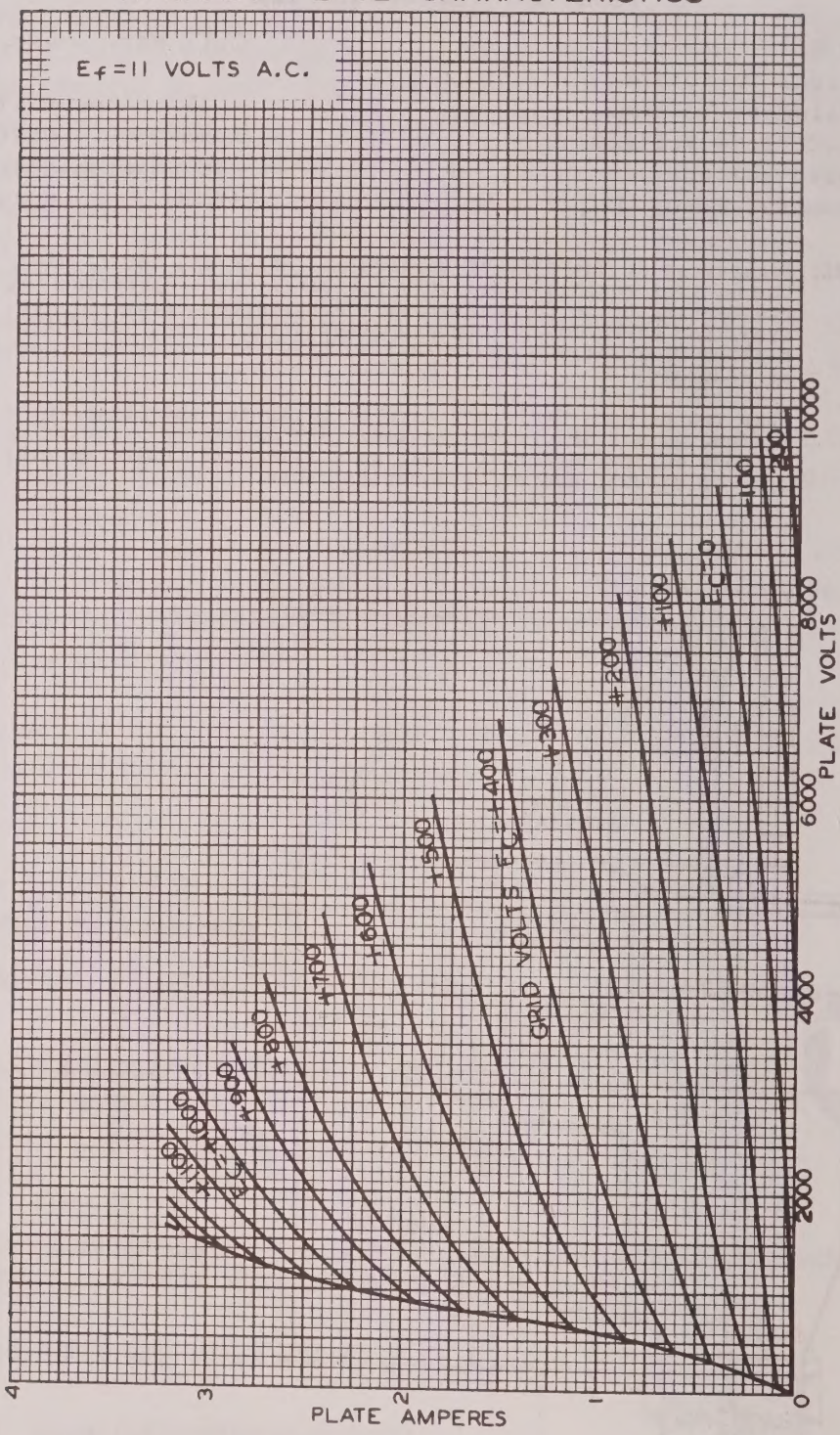



TUBE SYMBOL AND TERMINAL CONNECTIONS




A - Filament
B - Plate
C - Grid

# AVERAGE PLATE CHARACTERISTICS



848

# OSCILLATOR, R-F POWER AMPLIFIER, MODULATOR

(WATER COOLED)

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 22 | a-c or d-c volts |
| Current | 52 | amp. |
| Amplification Factor | 8 | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 27 | μμf |
| Grid to Filament | 18 | μμf |
| Plate to Filament | 2 | μμf |
| Maximum Overall Length | | 20-1/4" |
| Maximum Radius | | 6-1/2" |
| Bulb | | T-32 with arm |
| Base | | No. 3906 |
| Water Jacket | | UT-1285 |

## A-F POWER AMPLIFIER & MODULATOR - Class A

| | | |
|---|---|---|
| D-C Plate Voltage | 12000 max. | volts |
| Plate Dissipation | 7500 max. | watts |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 10000 | volts |
| Grid Voltage | -1040 approx. | volts |
| Peak Grid Swing | 1030 approx. | volts |
| D-C Plate Current | 0.65 | amp. |
| Load Resistance | 11500 | ohms |
| U.P.O.( 5% second harmonic) | 1930 | watts |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | |
|---|---|---|
| D-C Plate Voltage | 15000 max. | volts |
| D-C Plate Current (Averaged over any audio-frequency cycle) | 2.0 max. | amp. |
| Plate Dissipation (Averaged over any audio-frequency cycle) | 10000 max. | watts |
| Plate Input (Averaged over any audio-frequency cycle) | 25000 max. | watts |
| Typical Operation (2 tubes): | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 12000 | volts |
| Grid Voltage | -1600 approx. | volts |
| Zero-Signal Plate Cur. (per tube) | 0.1 | amp. |
| Max.-Signal Plate Cur. (per tube) | 1.8 | amp. |
| Nominal Power Output (2 tubes) | 27500 | watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 15000 max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 10000 max. | watts |
| R-F Grid Current | 20 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 13500 | volts |

848

# OSCILLATOR, R-F POWER AMPLIFIER, MODULATOR

(continued from preceding page)

| | | |
|---|---|---|
| Grid Voltage | -1900 approx. | volts |
| D-C Plate Current | 0.9 | amp. |
| Peak Power Output | 16000 approx. | watts |
| Nominal Carrier Power Output | 4000 | watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 10000 max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 6600 max. | watts |
| R-F Grid Current | 20 max. | amp. |
| D-C Grid Current | 0.2 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 a-c | volts |
| D-C Plate Voltage | 9000 | volts |
| Grid Voltage | -4000 approx. | volts |
| Nominal Power Output | 6000 | watts |

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | |
|---|---|---|
| D-C Plate Voltage | 15000 max. | volts |
| D-C Plate Current | 2.0 max. | amp. |
| Plate Dissipation | 10000 max. | watts |
| R-F Grid Current | 30 max. | amp. |
| D-C Grid Current | 0.2 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 a-c | volts |
| D-C Plate Voltage | 12000 | volts |
| Grid Voltage | -5000 approx. | volts |
| Nominal Power Output | 15000 | watts |

NOTE: Regardless of the type of service in which the 848 is used, the maximum ratings apply only for single-tube operation at frequencies below 1.5 megacycles ( wavelengths above 200 meters). For operation at higher frequencies, refer to TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY in front part of HANDBOOK.

When two or mor 848's are used in parallel, the plate voltage and output should be reduced. The amount of reduction depends on the number of tubes paralleled as well as the type of circuit and service contemplated.

OUTLINE DIMENSIONS, TUBE SYMBOL, and TERMINAL CONNECTIONS for the 848 are the same as for the 207.

# TRANSMITTING TUBE RATINGS

The filament or heater voltage given on the DATA pages is a normal value unless otherwise stated. This means that transformers and/or resistances in the cathode circuit should be designed to operate the filament or heater at rated value for full-load operating conditions under average line-voltage conditions. Variation from this rated value due to line voltage fluctuation or other causes, should not exceed plus or minus 5%.

In general, the filament of a transmitting tube may be operated with either a.c. or d.c. A.c. is usually employed unless d.c. is necessary from the standpoint of hum. With a-c operation, the grid return and the plate return should be connected to the mid-point of the cathode-supply winding of the transformer. When d-c is used, the return leads should be connected to the negative filament terminal.

It will be noted that typical operating conditions, particularly for the larger types, are given on the basis of *a-c filament excitation.* This has been done for uniformity in the presentation of the data. In case it is required to use d-c filament excitation on any filament type for which the data are given on an a-c basis, the grid-bias values as given on the respective DATA pages should be decreased by an amount approximately equal to one-half the rated filament voltage and be referred to the negative filament terminal instead of the mid-point (as in a-c operation).

In the rating of RCA transmitting tubes, certain values on the DATA pages are given as *MAXIMUM.* These are limiting values above which the serviceability of the tube will be impaired from the viewpoint of life and satisfactory performance. For example, a plate voltage rating of *2000 volts maximum* signifies a limiting value which should not be exceeded under the usual operating variation. If this limiting value is not to be exceeded, it will be necessary to determine the amount of plate-voltage fluctuation due to line-voltage variation, load variation, and manufacturing variation in the apparatus itself. An average design value must then be decided upon so that the maximum rated plate voltage will never be exceeded under the usual operating conditions.

The DATA pages also show *Typical Operation* values for each respective tube type in its recommended classes of operation. These values must not be considered as ratings, in as much as the tube can be used under any suitable conditions within the Maximum Ratings to obtain the required output. The output value for any operating condi-

# TRANSMITTING TUBE RATINGS

(continued from preceding page)

tion is an approximate tube output, i.e., tube input minus plate loss. Circuit losses must be subtracted from tube output in determining useful output. Since output values are approximate, they have been identified as *Nominal Power Output* values and are not to be used as output ratings. In the case of Class B audio-amplifier service, *nominal power output* is defined as the approximate power output at maximum-input signal.

The values under *Typical Operation* have been given in order to show concisely some guiding information for the use of each type. Since any transmitting type may be used under widely different conditions within Maximum Ratings, we suggest that you write us before you proceed with the design of equipment.

# TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY

The MAXIMUM RATINGS given for each type on its respective DATA page, apply only when the type is operated at a frequency below that shown for the type in Column I of the following table. At frequencies above this value, the radio-frequency currents, the dielectric losses and the consequent heating effects are greatly increased. For operation of a type at these higher frequencies, therefore, it is essential that the power input be reduced to prevent exceeding the maximum rated plate dissipation. Successful operation of each type listed below has been obtained in experimental circuits at the frequency shown in Column II. Operating considerations for each of the types at these higher frequencies follow under the proper footnote marking.

| TUBE TYPE | I | | II | |
|---|---|---|---|---|
| | FOR OPERATING CONDITIONS WITH MAXIMUM RATED POWER INPUT AND NOMINAL OUTPUT, RECOMMENDED FREQUENCIES ARE AS FOLLOWS: | | FOR OPERATING CONDITIONS WITH REDUCED POWER INPUT AND OUTPUT, FREQUENCIES HIGHER THAN THOSE FOR THE MAXIMUM CONDITIONS OF I MAY BE USED AS FOLLOWS: | |
| | *Megacycles* | *Meters* | *Megacycles* | *Meters* |
| 10-Special | Below 6 | Above 50 | 30* | 10 |
| *** 203-A | " 6 | " 50 | 30* | 10 |
| *** 204-A | " 3 | " 100 | 15* | 20 |
| 207 | " 1.5 | " 200 | 20* | 15 |
| *** 211 | " 6 | " 50 | 30* | 10 |
| *** 800 | " 60 | " 5 | 200** | 1.5 |
| 801 | " 60 | " 5 | 150** | 2 |
| 831 | " 20 | " 15 | 75** | 4 |
| *** 841 | " 6 | " 50 | 30* | 10 |
| 843 | " 6 | " 50 | 30* | 10 |
| 844 | " 8 | " 37.5 | 30* | 10 |
| 846 | " 50 | " 6 | 150** | 2 |
| 848 | " 1.5 | " 200 | 20* | 15 |
| *** 849 | " 3 | " 100 | 15* | 20 |
| 850 | " 13 | " 23.5 | 30* | 10 |
| 851 | " 3 | " 100 | 15* | 20 |
| *** 852 | " 30 | " 10 | 100** | 3 |
| 858 | " 1.5 | " 200 | 40* | 7.5 |
| *** 860 | " 30 | " 10 | 40* | 7.5 |
| 861 | " 20 | " 15 | 30* | 10 |
| 862 | " 1.5 | " 200 | - | - |
| 863 | " 1.5 | " 200 | 20* | 15 |
| *** 865 | " 15 | " 20 | 30* | 10 |
| 1652 | " 3 | " 100 | 6* | 50 |

* For operation of this type at the higher frequencies, the plate voltage must be reduced as the frequency is raised so that at this starred frequency the plate voltage, plate current, plate dissipation, and d-c grid current will not exceed 50% of the Maximum Rat-

*** See next page.

# TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY

(continued from preceding page)

ings. The r-f grid current under any conditions should never exceed the maximum rated value. Furthermore, special attention must be given to adequate ventilation and the maintenance of normal ambient temperatures.

** For operation of double-starred (**) types at the higher frequencies, the plate voltage and plate current must be reduced in approximate proportion as the frequency is raised, so that at this double-starred frequency the plate-input power will not exceed approximately

for the 800 - 50%
" " 801 - 55%
" " 831 - 55%
" " 846 - 50%
" " 852 - 75%

of that applied at Maximum Ratings. Furthermore, the d-c grid current should be reduced so that it will not exceed 50% of the maximum rated value. The r-f grid current under any conditions should never exceed the maximum rated value. Special attention must be given to adequate ventilation and the maintenance of normal ambient temperatures.

# Types marked (#) can be used as amplifiers at frequencies as high as indicated if effective shielding is provided by circuit design. The plate voltage and plate current must be reduced in approximate proportion as the frequency is raised, so that at this #-marked frequency the plate-input power will not exceed approximately

for the 860 - 80%
" " 861 - 75%
" " 865 - 75%

of that applied at Maximum Ratings. Furthermore, the d-c grid current should be reduced so that it will not exceed 50% of the maximum rated value. The r-f grid current under any conditions should never exceed the maximum rated value. Careful attention must be given to adequate ventilation and the maintenance of normal ambient temperatures.

*** Technical information on this type will be found in Booklet 464 - RCA de FOREST AMATEUR TRANSMITTING TYPES.

# DEFINITIONS

Definitions taken from the 1933 Report of the Standards Committee of the I.R.E. are followed by the definition number in the report.

*AMPLIFICATION FACTOR (u)* is a measure of the effectiveness of the control electrode voltage relative to that of the plate voltage upon the plate current. It is the ratio of the change in plate voltage to a change in control electrode voltage in the opposite direction, under the condition that the plate current remains unchanged. As most precisely defined, the term refers to infinitesimal changes as indicated by the defining equation,

$$\mu = - \left[ \frac{\partial e_p}{\partial e_g} \right] i_p \text{ constant}$$

13-043

*CLASS A AMPLIFIER:* An amplifier in which the grid bias and the exciting grid voltage are such that the plate current through the tube flows at all times.

The ideal Class A amplifier is one in which the alternating component of the plate current is an exact reproduction of the form of the alternating grid voltage, and the plate current flows during the 360 electrical degrees of the cycle.

The characteristics of a Class A amplifier are low efficiency and output. 13-201

*CLASS B AMPLIFIER:* An amplifier in which the grid bias is approximately equal to the cut-off value so that the plate current is approximately zero when no exciting grid voltage is applied, and so that the plate current in each tube flows during approximately one half of each cycle when an exciting grid voltage is present.

The ideal Class B amplifier is one in which the alternating component of plate current is an exact replica of the alternating grid voltage for the half cycle when the grid is positive with respect to the bias voltage, and the plate current flows during 180 electrical degrees of the cycle.

The characteristics of a Class B amplifier are medium efficiency and output. 13-202

*CLASS C AMPLIFIER:* An amplifier in which the grid bias is appreciably beyond the cut-off so that the plate current in each tube is zero when no exciting grid voltage is present, and so that the plate current flows in each tube for appreciably less than one half of each cycle when an exciting grid voltage is present.

Class C amplifiers find application where high plate-circuit efficiency is a paramount requirement and where departures from linearity between input and output are permissible.

The characteristics of a Class C amplifier are

# DEFINITIONS

(continued from preceding page)

high plate-circuit efficiency and high power output.
13-203

*MAXIMUM PEAK INVERSE VOLTAGE* is the highest peak voltage that a rectifier tube can safely stand in the direction opposite to that in which it is designed to pass current. In other words, it is the safe arc-back limit with the tube operating within the specified temperature range. The relations between peak inverse voltage, RMS value of a-c input voltage, and d-c output voltage depend largely on the individual characteristics of the rectifier circuit and the power supply. The presence of line surges, keying surges, or any other transient, or wave-form distortion may raise the actual peak voltage to a value higher than that calculated for sine-wave voltages. Therefore, the *actual* inverse voltage, and not the calculated value, should be such as not to exceed the rated maximum peak inverse voltage for the rectifier tube. A cathode-ray oscillograph or a spark gap connected across the tube is useful in determining the actual peak inverse voltage. In single-phase, full-wave circuits with sine-wave input, the peak inverse voltage on a rectifier tube is approximately 1.4 times the RMS value of the plate-to-plate voltage applied to the tubes. In single-phase, half-wave circuits with sine-wave input and with condenser input to the filter, the peak inverse voltage may be as high as 2.8 times the RMS value of the applied plate voltage. In polyphase circuits, the peak inverse voltage must be calculated for the individual case.

*MAXIMUM PEAK PLATE CURRENT* is the highest peak current that a rectifier tube can safely stand in the direction in which it is designed to pass current. The safe value of this peak current in hot-cathode types of rectifiers is a function of the electron emission available and the duration of the pulsating current flow from the rectifier tube during each half cycle. In a given circuit, the value of peak plate current is largely determined by filter constants. If a large choke is used in the filter circuit next to the rectifier tube(s), the peak plate current is not much greater than the load current; but if a large condenser is used in the filter next to the rectifier tube(s), the peak current is often many times the load current. In order to determine accurately the peak current in any circuit, the best procedure usually is to measure it with a peak-indicating meter or to use an oscillograph.

# 10-SPECIAL*

# POWER AMPLIFIER, OSCILLATOR

** For applications critical as to microphonics.*

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 7.5 | a-c or d-c volts |
| Current | 1.25 | amp. |
| Amplification Factor | 8 | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 7 | μμf |
| Grid to Filament | 4 | μμf |
| Plate to Filament | 3 | μμf |
| Maximum Overall Length | | 5-5/8" |
| Maximum Diameter | | 2-3/16" |
| Bulb | | S-17 |
| Base | | Medium 4-Pin Bayonet |

## A-F POWER AMPLIFIER & MODULATOR - Class A

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 425 max. | volts |
| Plate Dissipation | | | 12 max. | watts |
| Typical Operation: | | | | |
| Filament Voltage | 7.5 | 7.5 | 7.5 | a-c volts |
| Plate Voltage | 250 | 350 | 425 | volts |
| Grid Voltage | -22 | -31 | -39 | volts |
| Peak Grid Swing | 18 | 27 | 35 | volts |
| Plate Current | 10 | 16 | 18 | ma. |
| Mutual Conductance | 1330 | 1550 | 1600 | μmhos |
| Plate Resistance | 6000 | 5150 | 5000 | ohms |
| Load Resistance | 13000 | 11000 | 10200 | ohms |
| U.P.O. (5% second harmonic) | 0.4 | 0.9 | 1.6 | watts |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 425 max. | volts |
| D-C Plate Current } Averaged over any | | | 60 max. | ma. |
| Plate Dissipation } audio-frequency cycle | | | 12 max. | watts |
| Typical Operation (2 tubes): | | | | |
| Filament Voltage | 7.5 | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | 250 | 350 | 425 | volts |
| Grid Voltage | -28 | -40 | -50 | approx. volts |
| Zero-Sig. Plate Cur.(per tube) | 4 | 4 | 4 | ma. |
| Max.-Sig. Plate Cur.(per tube) | 55 | 55 | 55 | ma. |
| Load Resistance (per tube) | 1000 | 1500 | 2000 | ohms |
| Effective Load Res. (plate to plate) | 4000 | 6000 | 8000 | ohms |
| Power Output ( 2 tubes ) | 13 | 20 | 25 | approx. watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 450 max. | volts |
| D-C Plate Current | | | 40 max. | ma. |
| Plate Dissipation | | | 15 max. | watts |
| R-F Grid Current | | | 4 max. | amp. |
| Typical Operation: | | | | |
| Filament Voltage | | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | | 350 | 450 | volts |

# 10-SPECIAL

# POWER AMPLIFIER, OSCILLATOR

(continued from preceding page)

| | | | |
|---|---|---|---|
| Grid Voltage | -40 | -53 | approx. volts |
| D-C Plate Current | 35 | 35 | ma. |
| Peak Power Output | 12 | 16 | approx. watts |
| Carrier Power Output | 3 | 4 | approx. watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 350 max. | volts |
| D-C Plate Current | | 50 max. | ma. |
| Plate Dissipation | | 10 max. | watts |
| R-F Grid Current | | 4 max. | amp. |
| D-C Grid Current | | 15 max. | ma. |
| Typical Operation: | | | |
| Filament Voltage | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | 250 | 350 | volts |
| Grid Voltage | -95 | -135 | approx. volts |
| D-C Plate Current | 45 | 45 | ma. |
| D-C Grid Current* | 15 | 15 | ma. |
| Driving Power* | 3 | 3.5 | watts |
| Power Output | 5.5 | 8 | approx. watts |

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

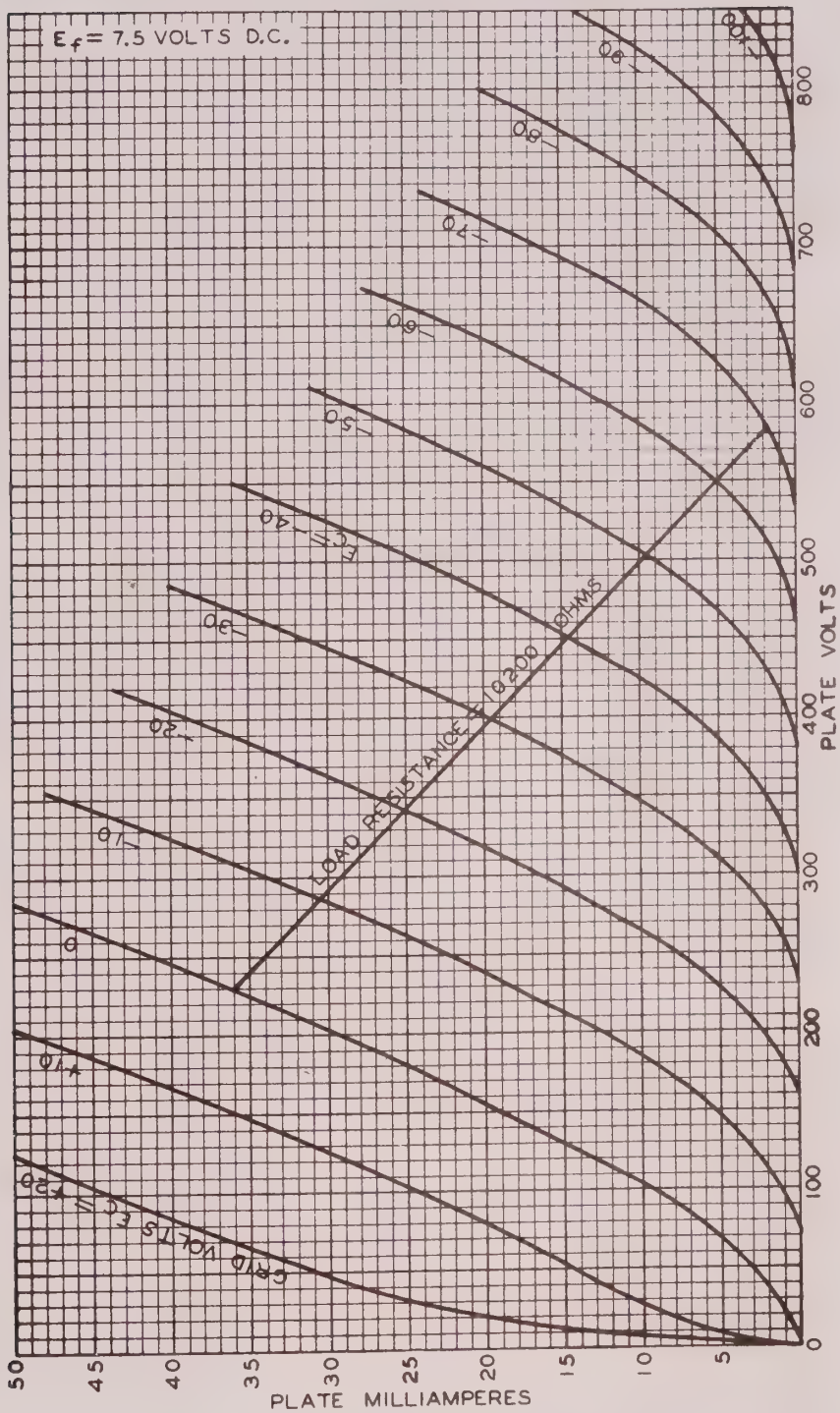
| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 450 max. | volts |
| D-C Plate Current | | 60 max. | ma. |
| Plate Dissipation | | 15 max. | watts |
| R-F Grid Current | | 5 max. | amp. |
| D-C Grid Current | | 15 max. | ma. |
| Typical Operation: | | | |
| Filament Voltage | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | 350 | 450 | volts |
| Grid Voltage | -90 | -115 | approx. volts |
| D-C Plate Current | 55 | 55 | ma. |
| D-C Grid Current* | 15 | 15 | ma. |
| Driving Power* | 3 | 3.3 | watts |
| Power Output | 9 | 13 | approx. watts |

* Subject to wide variations depending on the impedance of the load circuit. High impedance load circuits require more grid current and driving power to obtain the desired output. Low impedance circuits need less grid current and driving power, but plate circuit efficiency is sacrificed. The driving stage should have a tank circuit of good regulation and should be capable of delivering considerably more than the required driving power.

OUTLINE DIMENSIONS, TUBE SYMBOL, and SOCKET CONNECTIONS for the 10-Special are the same as for the 841.

10-SPECIAL

## AVERAGE PLATE CHARACTERISTICS



# 206

# OSCILLATOR, R-F POWER AMPLIFIER

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 11.0 | a-c or d-c volts |
| Current | 14.75 | amp. |
| Amplification Factor | 350 | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 11 | μμf |
| Grid to Filament | 10 | μμf |
| Plate to Filament | 1 | μμf |
| Overall Length | | 15-3/8" ± 1/8" |
| Maximum Radius | | 3-1/2" |
| Bulb | | GT-40 with arm |
| Cap (Plate connection) | | No. 1904 |
| Base (Filament connected to post terminals; no connection to blade; grid connected to side arm.) | | No. 3502 |
| End-Mountings | | UT-1085 & UT-1086 |

R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 15000 max. | volts |
| D-C Plate Current | 50 max. | ma. |
| Plate Dissipation | 350 max. | watts |
| R-F Grid Current | 10 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 15000 | volts |
| Grid Voltage | -50 approx. | volts |
| D-C Plate Current | 35 | ma. |
| Peak Power Output | 700 | watts |
| Carrier Power Output | 175 approx. | watts |

R-F POWER AMPLIFIER & OSCILLATOR - Class C

| | | |
|---|---|---|
| D-C Plate Voltage (Modulated) | 12000 max. | volts |
| D-C Plate Voltage (Unmodulated) | 15000 max. | volts |
| D-C Plate Current | 100 max. | ma. |
| Plate Dissipation | 350 max. | watts |
| R-F Grid Current | 10 max. | amp. |
| D-C Grid Current | 30 max. | ma. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 15000 | volts |
| Grid Voltage | -500 approx. | volts |
| Power Output | 1000 approx. | watts |

NOTE: The 206 is not designed nor recommended for operation at frequencies greater than 3000 kilocycles (wavelengths less than 100 meters). For use at these higher frequencies, there are specially designed Radiotrons. Regardless of the frequency at which the 206 is operated, the r-f grid current should never exceed 10 amperes.

PRELIMINARY
RCA

RCA

# 207

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(WATER COOLED)

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 22 | a-c or d-c volts |
| Current | 52 | amp. |
| Amplification Factor | 20 | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 27 | μμf |
| Grid to Filament | 18 | μμf |
| Plate to Filament | 2 | μμf |
| Maximum Overall Length | | 20-1/4" |
| Maximum Radius | | 6-1/2" |
| Bulb | | T-32 with arm |
| Base | | No. 3906 |
| Water Jacket | | UT-1285 |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 15000 max. | volts |
| Plate Dissipation | Averaged over any audio-frequency cycle | 7500 max. | watts |
| Plate Input | Averaged over any audio-frequency cycle | 15000 max. | watts |
| Typical Operation (2 tubes): | | | |
| Filament Voltage | | 22 | a-c volts |
| D-C Plate Voltage | | 13500 | volts |
| Grid Voltage | | -620 approx. | volts |
| Zero-Signal Plate Cur. (per tube) | | 0.2 | amp. |
| Max.-Signal Plate Cur. (per tube) | | 1.1 | amp. |
| Nominal Power Output (2 tubes) | | 16500 | watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 15000* max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 10000 max. | watts |
| R-F Grid Current | 30 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 13500 | volts |
| Grid Voltage | -700 approx. | volts |
| D-C Plate Current | 0.9 | amp. |
| Peak Power Output | 16000 approx. | watts |
| Nominal Carrier Power Output | 4000 | watts |

* This is the maximum safe plate voltage for this service when the 207 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). When 207's are used in parallel or at frequencies above 1500 kc, the plate voltage and output per tube should be decreased, and in addition the load should be balanced between tubes. For operation of the 207 at the higher frequencies, refer to TABLE I on next page.

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 10000** max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 6600 max. | watts |
| R-F Grid Current | 20 max. | amp. |
| D-C Grid Current | 0.2 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 a-c | volts |
| D-C Plate Voltage | 9000 | volts |
| Grid Voltage | -2000 approx. | volts |
| Nominal Power Output | 6000 | watts |

** This is the maximum safe plate voltage for this service when the 207 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). The high a-c peaks encountered when modulating necessitate the use of reduced plate voltage and current as compared with the unmodulated Class C service given below. For operation of the 207 at the higher frequencies, refer to TABLE II on next page.

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | |
|---|---|---|
| D-C Plate Voltage | 15000° max. | volts |
| D-C Plate Current | 2.0 max. | amp. |
| Plate Dissipation | 10000 max. | watts |
| R-F Grid Current | 30 max. | amp. |
| D-C Grid Current | 0.2 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 a-c | volts |
| D-C Plate Voltage | 12000 | volts |
| Grid Voltage | -2200 approx. | volts |
| Nominal Power Output | 15000 | watts |

° This is the maximum safe plate voltage for this service when the 207 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). When 207's are operated in parallel or at frequencies above 1500 kc, the plate voltage and output per tube should be decreased, and in addition the load should be balanced between tubes. For operation of the 207 at the higher frequencies refer to TABLE III on next page.

TABLE I

*Carrier Conditions; for use with a Modulation Factor up to 1.0*

| FREQUENCY kc | MAX. D-C PLATE VOLTS | APPROX. GRID BIAS VOLTS | TYPICAL VALUES OF D-C PLATE AMP. | PLATE DISSIPATION WATTS | PEAK OUTPUT WATTS | CARRIER OUTPUT WATTS |
|---|---|---|---|---|---|---|
| 1500 | 15000 | -800 | 1.00 | 10000 | 20000 | 5000 |
| 2500 | 14100 | -750 | 0.97 | 9000 | 18000 | 4500 |
| 3750 | 13200 | -700 | 0.93 | 8300 | 16000 | 4000 |
| 7500 | 11400 | -600 | 0.83 | 6400 | 12000 | 3000 |
| 15000 | 8900 | -470 | 0.65 | 4100 | 7000 | 1700 |
| 20000 | 7500 | -400 | 0.59 | 3200 | 5000 | 1200 |

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

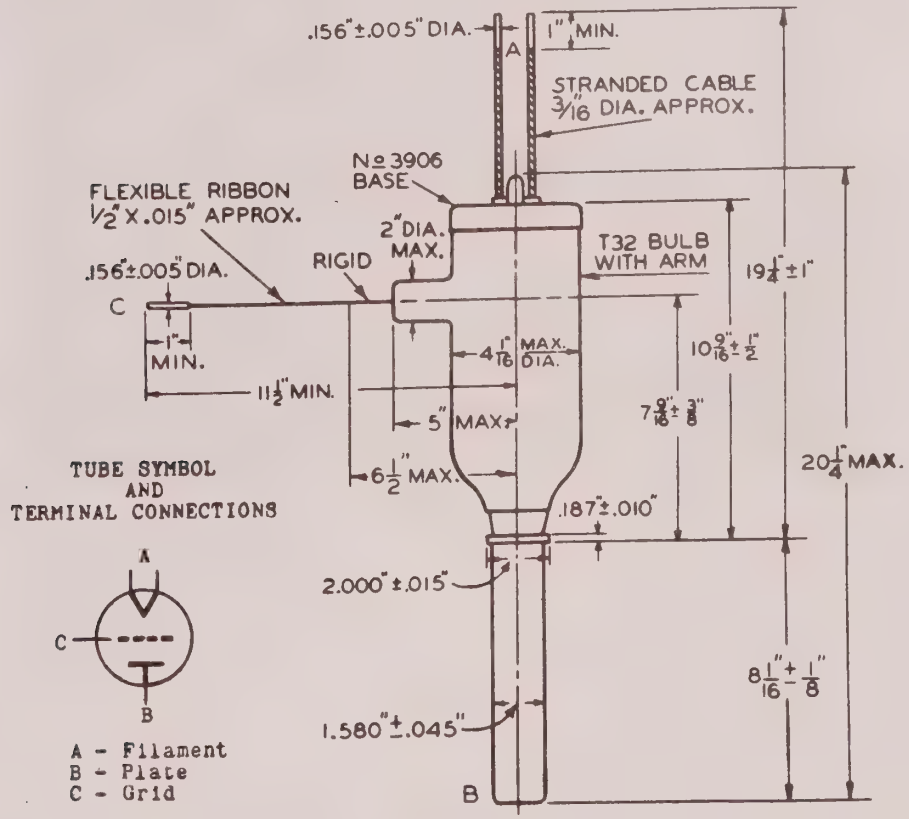
(continued from preceding page)

TABLE II

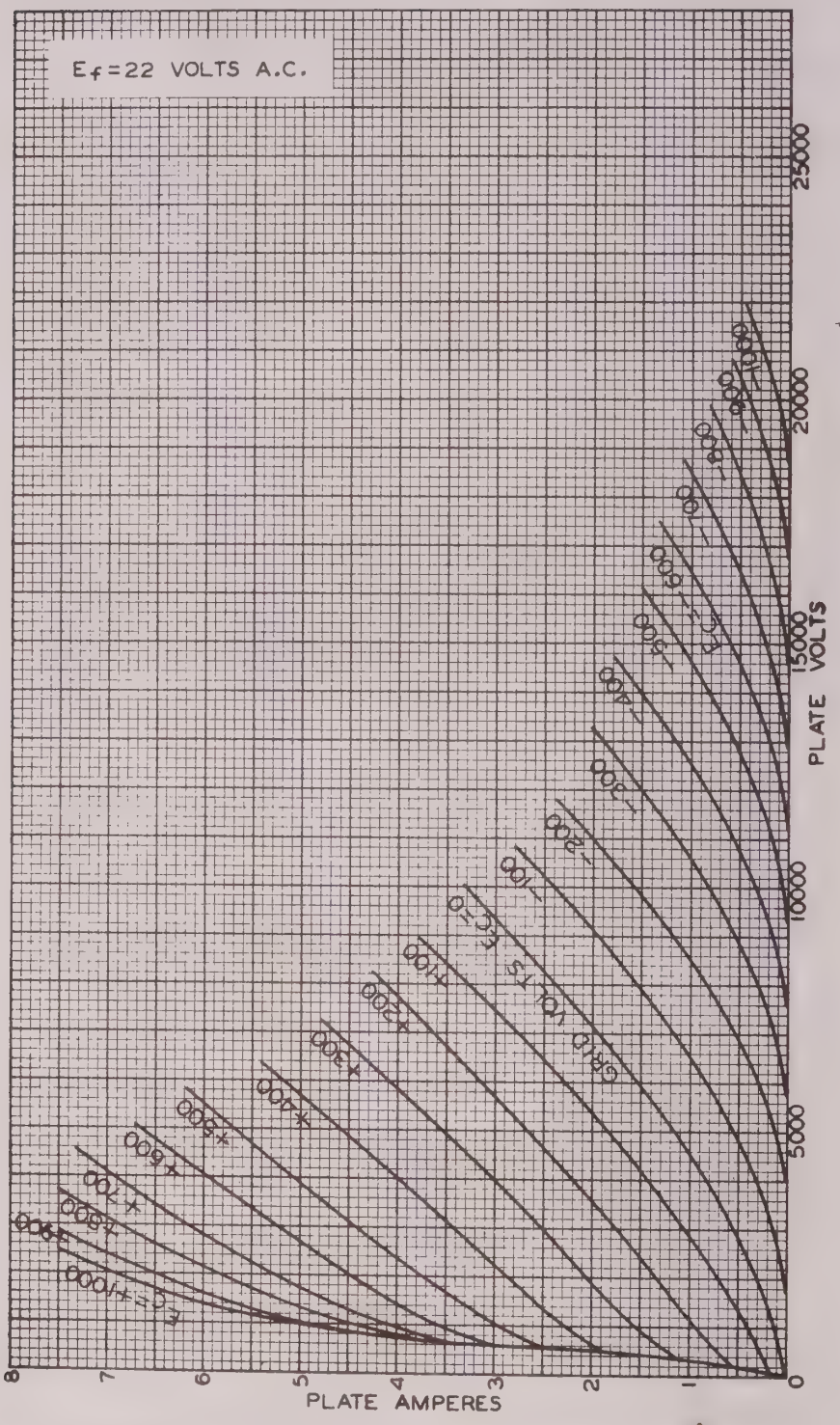
| *Carrier Conditions; for use with a Modulation Factor up to 1.0* | | | | |
|---|---|---|---|---|
| | MAX. | APPROX. | TYPICAL VALUES OF | |
| FREQUENCY kc | D-C PLATE VOLTS | GRID BIAS VOLTS | D-C PLATE AMPERES | POWER OUTPUT WATTS |
| 1500 | 10000 | -2100 | 1.0 | 6600 |
| 3200 | 9000 | -2000 | 1.0 | 6000 |
| 6000 | 8000 | -1800 | 1.0 | 5200 |
| 9600 | 7000 | -1600 | 1.0 | 4500 |
| 14400 | 6000 | -1450 | 0.9 | 3700 |
| 20000 | 5000 | -1300 | 0.8 | 3000 |

TABLE III

| *Key-down Conditions* | | | | |
|---|---|---|---|---|
| | MAX. | APPROX. | TYPICAL VALUES OF | |
| FREQUENCY kc | D-C PLATE VOLTS | GRID BIAS VOLTS | D-C PLATE AMPERES | POWER OUTPUT WATTS |
| 1500 | 15000 | -3000 | 2.0 | 20000 |
| 2500 | 14100 | -2800 | 1.9 | 18000 |
| 3750 | 13200 | -2670 | 1.8 | 16000 |
| 7500 | 11400 | -2380 | 1.7 | 12000 |
| 15000 | 8900 | -1950 | 1.4 | 7500 |
| 20000 | 7500 | -1700 | 1.3 | 5500 |



# AVERAGE PLATE CHARACTERISTICS



# 214

# HALF-WAVE RECTIFIER

(WATER COOLED)

| | | |
|---|---|---|
| Filament* | Tungsten | |
| Voltage | 22 | a-c volts |
| Current | 52 | amp. |
| Maximum Overall Length | | 20-1/4" |
| Maximum Diameter | | 4-5/32" |
| Bulb | | T-32 |
| Base# | | No. 3911 |
| Water Jacket | | UT-1285 |
| Peak Inverse Voltage | 50000 max. | volts |
| Peak Plate Current° | 7.5 max. | amp. |

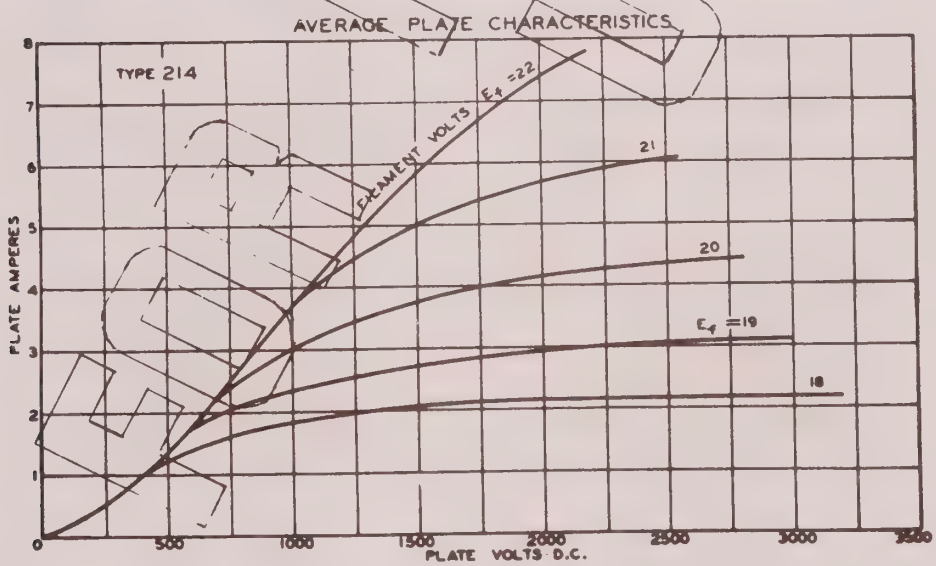
* The filament of the 214 should be allowed to come up to operating temperature before plate voltage is applied.

\# Base shell is connected within base to one filament lead.

° Operation at the maximum peak current rating of 7.5 amperes requires that precautions be taken to maintain exactly the rated filament voltage of 22 volts. When operating conditions are such, however, that the peak current is less than the full rated value, the regulation of the filament voltage need not be so exact. The permissible variation will depend on the magnitude of the peak current and will increase with decreased values of peak current. Table I shows the maximum operating range of filament voltage for several maximum values of peak plate current.

TABLE I

| MAXIMUM PEAK PLATE CURRENT Amperes | MAXIMUM RANGE OF FILAMENT VOLTAGE Volts |
|---|---|
| 7.5 | 22.0 exact |
| 6.0 | 22.0 - 21.5 |
| 5.0 | 22.0 - 21.0 |
| 4.0 | 22.0 - 20.5 |

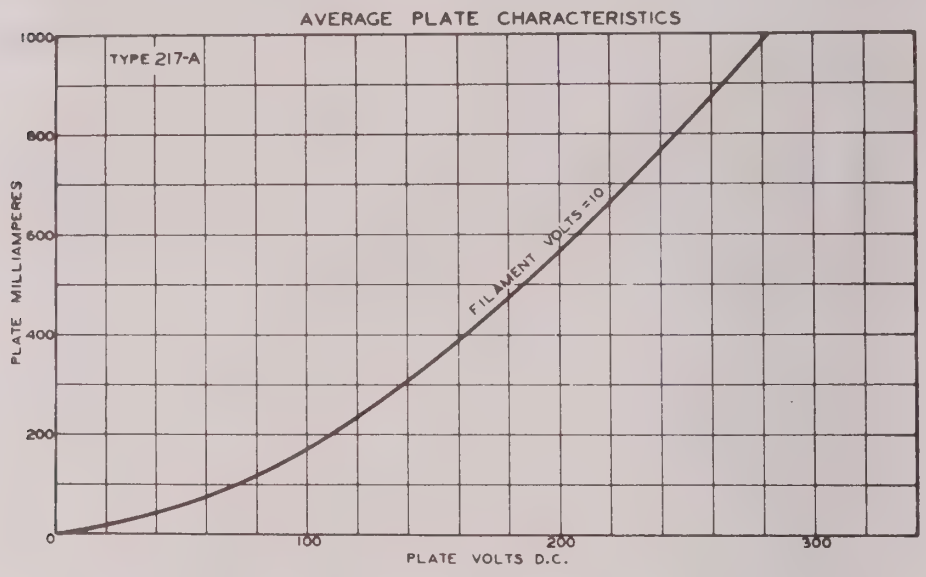


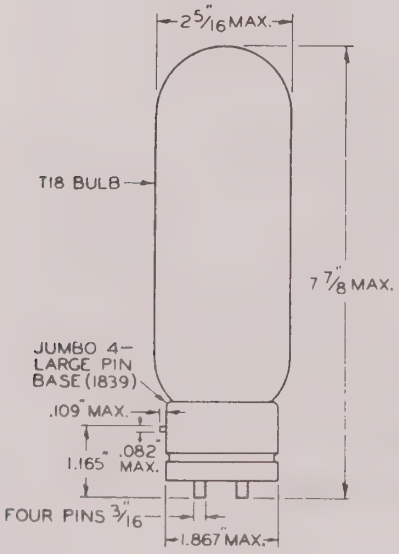
RCA

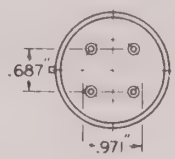
217-A

# HALF-WAVE RECTIFIER

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 10.0 | a-c volts |
| Current | 3.25 | amp. |
| Maximum Overall Length | | 7-7/8" |
| Maximum Diameter | | 2-5/16" |
| Bulb | | T-18 |
| Base | | Jumbo 4-Large Pin |
| Peak Inverse Voltage | | 3500 max. volts |
| Peak Plate Current | | 0.6 max. amp. |

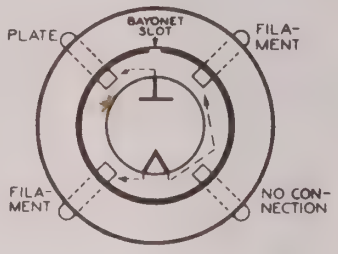



BOTTOM VIEW OF BASE

TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS

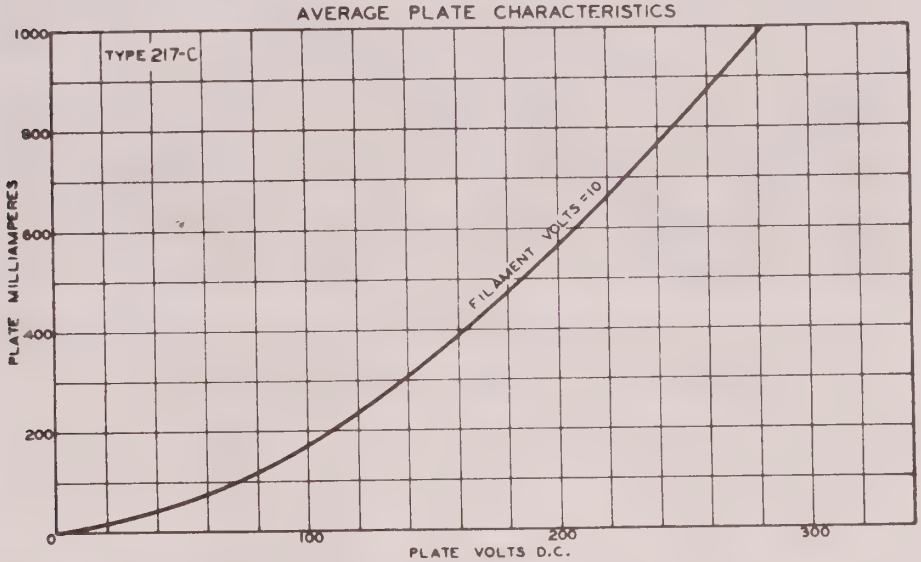


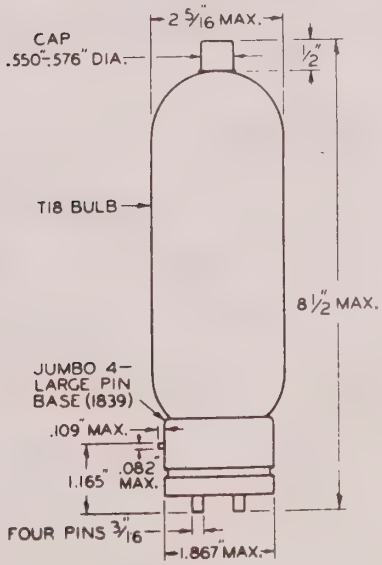
# 217-C

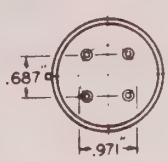
# HALF-WAVE RECTIFIER

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 10.0 | a-c volts |
| Current | 3.25 | amp. |
| Maximum Overall Length | | 8-1/2" |
| Maximum Diameter | | 2-5/16" |
| Bulb | | T-18 |
| Cap | | Medium Metal |
| Base | | Jumbo 4-Large Pin |
| Peak Inverse Voltage | | 7500 max. volts |
| Peak Plate Current | | 0.6 max. amp. |

AVERAGE PLATE CHARACTERISTICS

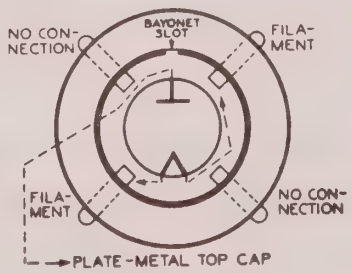



BOTTOM VIEW OF BASE

TUBE SYMBOL & TOP VIEW
OF
SOCKET CONNECTIONS



# 218

# HALF-WAVE RECTIFIER

| | | |
|---|---|---|
| Filament* | Tungsten | |
| Voltage | 11.0 | a-c volts |
| Current | 14.75 | amp. |
| Overall Length | | 15-3/8" ± 1/8" |
| Maximum Diameter | | 5-1/16" |
| Bulb | | GT-40 |
| Cap | | No. 1004 |
| Base# | | No. 5505 |
| Peak Inverse Voltage | | 50000 max. volts |
| Peak Plate Current° | | 0.75 max. amp. |

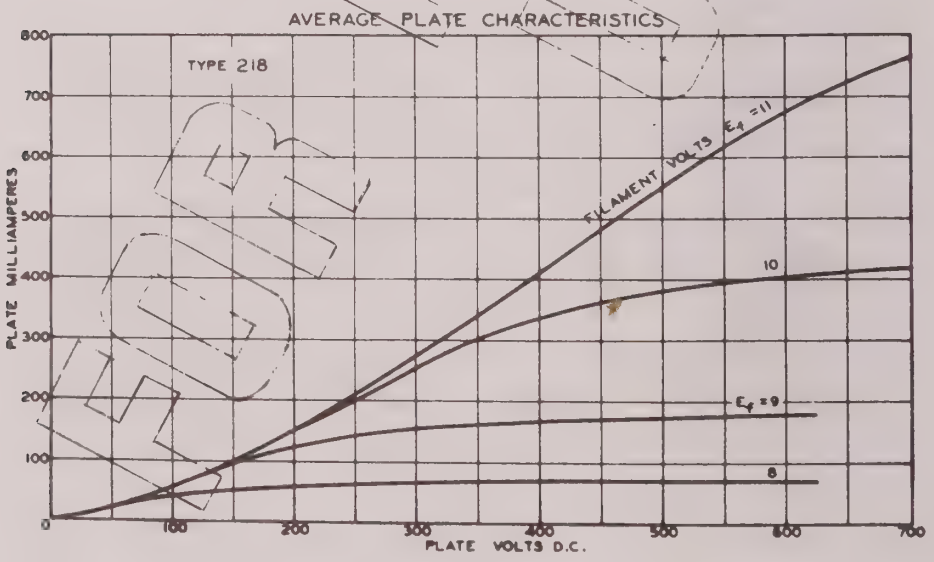
* The filament of the 218 should be allowed to come up to operating temperature before plate voltage is applied.

\# Base shell is connected within base to one filament lead.

° Operation at the maximum peak current rating of 0.75 ampere requires that precautions be taken to maintain exactly the filament voltage of 11 volts. When operating conditions are such, however, that the peak current is less than the full rated value, the regulation of the filament voltage need not be so exact. The permissible variation will depend on the magnitude of the peak current, and will increase with decreased values of peak current. Table I shows the maximum operating range of filament voltage for several maximum values of peak plate current.

TABLE I

| MAXIMUM PEAK PLATE CURRENT Amperes | MAXIMUM RANGE OF FILAMENT VOLTAGE Volts |
|---|---|
| 0.75 | 11.0 exact |
| 0.60 | 11.0 - 10.75 |
| 0.50 | 11.0 - 10.5 |
| 0.40 | 11.0 - 10.25 |



# 219

# HALF-WAVE RECTIFIER

| | | |
|---|---|---|
| Filament* | Tungsten | |
| Voltage | 22.0 | a-c volts |
| Current | 24.5 | amp. |
| Overall Length | | 22-3/8" ± 3/16" |
| Maximum Diameter | | 6-1/8" |
| Bulb | | T-48 |
| Cap | | No. 3902 |
| Base# | | No. 3505 |
| Peak Inverse Voltage | | 50000 max. volts |
| Peak Plate Current° | | 2.5 max. amp. |

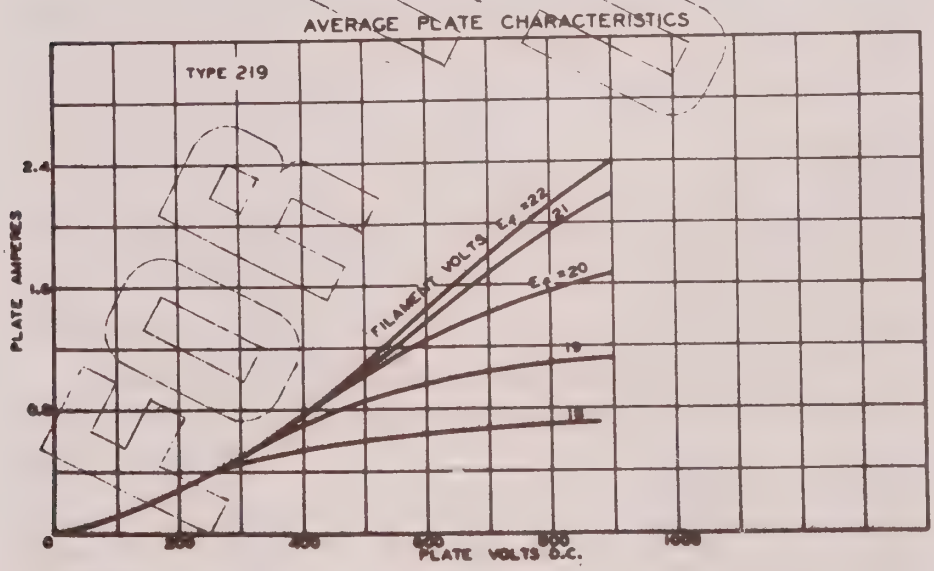
* The filament of the 219 should be allowed to come up to operating temperature before plate voltage is applied.

\# Base shell is connected within base to one filament lead.

° Operation at the maximum peak current rating of 2.5 amperes requires that precautions be taken to maintain exactly the filament voltage of 22 volts. When operating conditions are such, however, that the peak current is less than the full rated value, the regulation of the filament voltage need not be so exact. The permissible variation will depend on the magnitude of the peak current, and will increase with decreased values of peak current. Table I shows the maximum operating range of filament voltage for several maximum values of peak plate current.

TABLE I

| MAXIMUM PEAK PLATE CURRENT Amperes | MAXIMUM RANGE OF FILAMENT VOLTAGE Volts |
|---|---|
| 2.5 | 22.0 exact |
| 2.0 | 22.0 - 21.5 |
| 1.7 | 22.0 - 21.0 |
| 1.4 | 22.0 - 20.5 |



801

# OSCILLATOR, R-F POWER AMPLIFIER, A-F POWER AMPLIFIER, MODULATOR

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 7.5 | a-c or d-c volts |
| Current | 1.25 | amp. |
| Amplification Factor | 8 | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 6.0 | μμf |
| Grid to Filament | 4.5 | μμf |
| Plate to Filament | 1.5 | μμf |
| Maximum Overall Length | | 5-3/8" |
| Maximum Diameter | | 2-1/16" |
| Bulb | | ST-16 |
| Base | | Medium 4-Pin Ceramic, Bayonet |

## A-F POWER AMPLIFIER & MODULATOR - Class A

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 600 max. | volts |
| Plate Dissipation | | | 20 max. | watts |
| Typical Operation: | | | | |
| Filament Voltage | 7.5 | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | 425 | 500 | 600 | volts |
| Grid Voltage# | -39 | -45 | -55 | approx. volts |
| Peak Grid Swing | 34 | 40 | 50 | approx. volts |
| D-C Plate Current | 18 | 24 | 30 | ma. |
| Mutual Conductance | 1600 | 1725 | 1840 | μmhos |
| Plate Resistance | 5000 | 4600 | 4300 | ohms |
| Load Resistance | 10200 | 8000 | 7800 | ohms |
| U.P.O. (5% second harmonic) | 1.6 | 2.3 | 3.8 | watts |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 600 max. | volts |
| D-C Plate Current } Averaged over any | | | 70 max. | ma. |
| Plate Dissipation } audio-frequency cycle | | | 20 max. | watts |
| Typical Operation (2 tubes): | | | | |
| Filament Voltage | 7.5 | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | 400 | 500 | 600 | volts |
| Grid Voltage# | -50 | -60 | -75 | approx. volts |
| Zero-Sig. Plate Cur. (per tube) | 4 | 4 | 4 | ma. |
| Max.-Sig. Plate Cur. (per tube) | 65 | 65 | 65 | ma. |
| Load Resistance (per tube) | 1500 | 2000 | 2500 | ohms |
| Effective Load Res. (plate to plate) | 6000 | 8000 | 10000 | ohms |
| Power Output ( 2 tubes ) | 27 | 36 | 45 | approx. watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 600 max. | volts |
| D-C Plate Current | | | 50 max. | ma. |
| Plate Dissipation | | | 20 max. | watts |
| R-F Grid Current | | | 4 max. | amp. |
| Typical Operation: | | | | |
| Filament Voltage | | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | | 500 | 600 | volts |

**# See next page.**

# OSCILLATOR, R-F POWER AMPLIFIER, A-F POWER AMPLIFIER, MODULATOR

(continued from preceding page)

| | | | |
|---|---|---|---|
| Grid Voltage# | -60 | -75 | approx. volts |
| D-C Plate Current | 45 | 45 | ma. |
| Peak Power Output | 24 | 30 | approx. watts |
| Carrier Power Output | 6 | 7.5 | approx. watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 500 max. | volts |
| D-C Plate Current | | 60 max. | ma. |
| Plate Dissipation | | 13.5 max. | watts |
| R-F Grid Current | | 4 max. | amp. |
| D-C Grid Current | | 15 max. | ma. |
| Typical Operation: | | | |
| Filament Voltage | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | 400 | 500 | volts |
| Grid Voltage# | -150 | -190 | approx. volts |
| D-C Plate Current | 55 | 55 | ma. |
| D-C Grid Current* | 15 | 15 | ma. |
| Driving Power* | 4 | 4.5 | watts |
| Power Output | 14 | 18 | approx. watts |

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 600 max. | volts |
| D-C Plate Current | | 70 max. | ma. |
| Plate Dissipation | | 20 max. | watts |
| R-F Grid Current | | 5 max. | amp. |
| D-C Grid Current | | 15 max. | ma. |
| Typical Operation: | | | |
| Filament Voltage | 7.5 | 7.5 | a-c volts |
| D-C Plate Voltage | 500 | 600 | volts |
| Grid Voltage# | -125 | -150 | approx. volts |
| D-C Plate Current | 65 | 65 | ma. |
| D-C Grid Current* | 15 | 15 | ma. |
| Driving Power* | 3.5 | 4 | watts |
| Power Output | 20 | 25 | approx. watts |

# Grid voltages are given with respect to the mid-point of filament operated on a.c. If d.c. is used, each stated value of grid voltage should be decreased by 5.0 volts and should be referred to the negative end of the filament.

* Subject to wide variations depending on the impedance of the load circuit. High impedance load circuits require more grid current and driving power to obtain the desired output. Low impedance circuits need less grid current and driving power, but plate circuit efficiency is sacrificed. The driving stage should have a tank circuit of good regulation and should be capable of delivering considerably more than the required driving power.

## OPERATION AT FREQUENCIES ABOVE 60 MC.

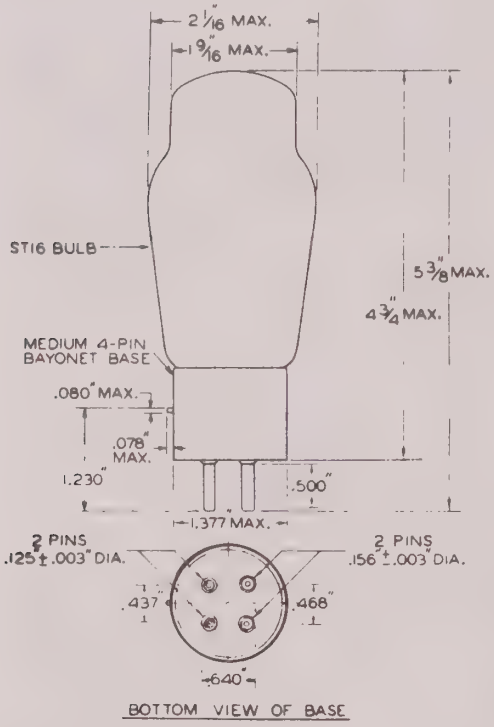
The 801 may be used at full ratings as high as 60 megacycles. At higher frequencies, the plate voltage should be reduced as the frequency is raised with corresponding

# OSCILLATOR, R-F POWER AMPLIFIER, A-F POWER AMPLIFIER, MODULATOR

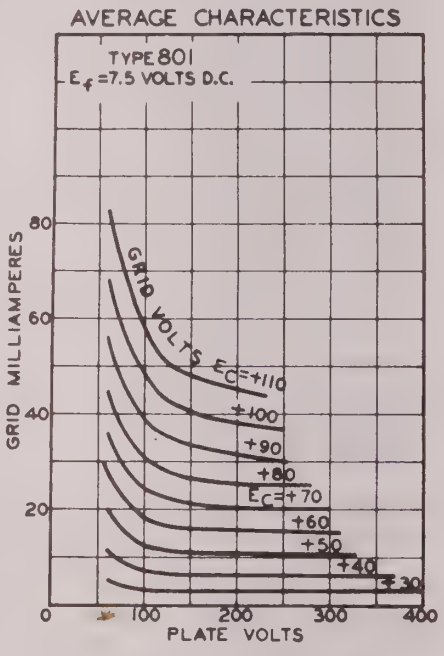
(continued from preceding page)

decrease in power output. Recommended maximum plate voltages for the 801 at frequencies between 60 and 150 megacycles ( 5 to 2 meters ) follow:

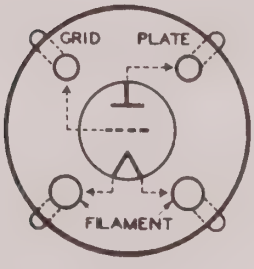
| FREQUENCY | MAXIMUM PLATE VOLTS | | |
|---|---|---|---|
| Megacycles | Class B Telephony | Class C Telegraphy | Class C Telephony |
| 60 | 480 | 600 | 480 |
| 90 | 360 | 455 | 360 |
| 120 | 310 | 390 | 310 |
| 150 | 260 | 330 | 260 |




BOTTOM VIEW OF BASE




TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS



RCA

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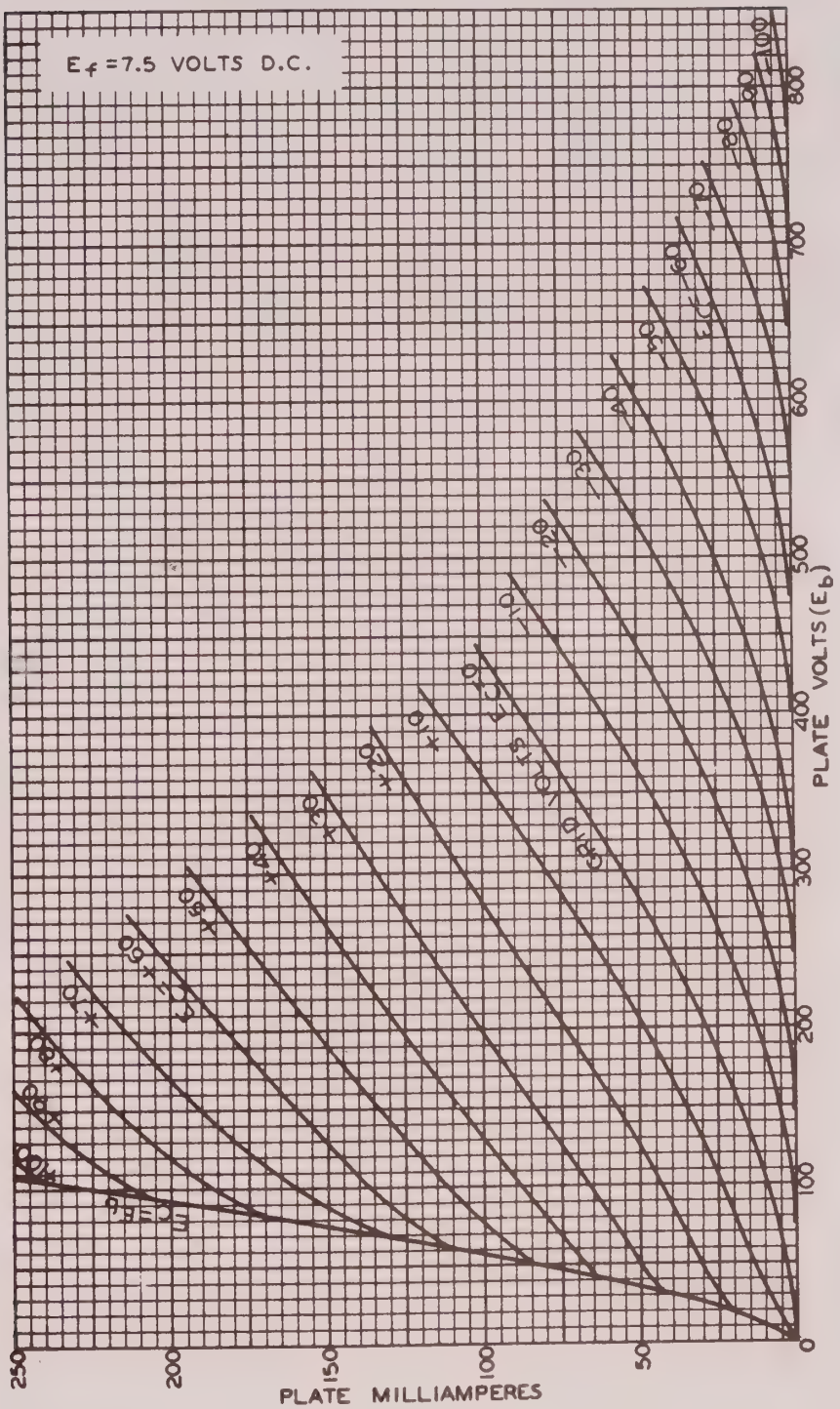
## AVERAGE PLATE CHARACTERISTICS



# 831

# OSCILLATOR, R-F POWER AMPLIFIER

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 11 | a-c or d-c volts |
| Current | 10 | amp. |
| Amplification Factor | 14.5 | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 4.0 | μμf |
| Grid to Filament | 3.8 | μμf |
| Plate to Filament | 1.4 | μμf |
| Overall Length | | 17-3/32" ± 1/8" |
| Maximum Radius | | 6-5/8" |
| Bulb | | GT-56 with arm |
| Cap | | No. 3909 |
| Base | | No. 3503 |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 3500 max. | | volts |
| D-C Plate Current | 250 max. | | ma. |
| Plate Dissipation | 400 max. | | watts |
| R-F Grid Current | 7 max. | | amp. |
| Typical Operation: | | | |
| Filament Voltage | 11 | 11 | a-c volts |
| D-C Plate Voltage | 3000 | 3500 | volts |
| Grid Voltage | -185 | -220 | approx. volts |
| D-C Plate Current | 167 | 146 | ma. |
| Peak Power Output | 600 | 640 | watts |
| Nominal Carrier Power Output | 150 | 160 | watts |

## PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 3000 max. | | volts |
| D-C Plate Current | 300 max. | | ma. |
| Plate Dissipation | 270 max. | | watts |
| R-F Grid Current | 7 max. | | amp. |
| D-C Grid Current | 75 max. | | ma. |
| Typical Operation: | | | |
| Filament Voltage | 11 | 11 | a-c volts |
| D-C Plate Voltage | 2500 | 3000 | volts |
| Grid Voltage | -400 | -500 | approx. volts |
| D-C Plate Current | 225 | 200 | ma. |
| Nominal Power Output | 320 | 360 | watts |

## R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | |
|---|---|---|
| D-C Plate Voltage | 3500 max. | volts |
| D-C Plate Current | 350 max. | ma. |
| Plate Dissipation | 400 max. | watts |
| R-F Grid Current | 10 max. | amp. |
| D-C Grid Current | 75 max. | ma. |

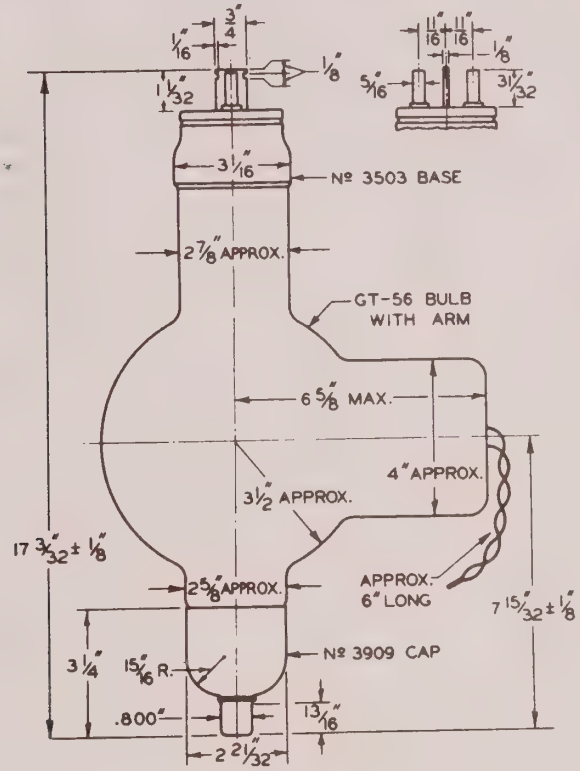
# 831

# OSCILLATOR, R-F POWER AMPLIFIER

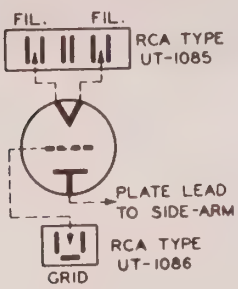
(continued from preceding page)

| Typical Operation: | | | | |
|---|---|---|---|---|
| Filament Voltage | 11 | 11 | 11 | a-c volts |
| D-C Plate Voltage | 2000 | 3000 | 3500 | volts |
| Grid Voltage | -200 | -300 | -400 | approx. volts |
| D-C Plate Current | 300 | 300 | 275 | ma. |
| Nominal Power Output | 325 | 540 | 590 | watts |

**NOTE:** Regardless of the type of service in which the 831 is used, the maximum ratings apply only for operation at frequencies below approximately 20 megacycles (wavelengths above 15 meters). For operation at higher frequencies, refer to TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY in front part of HANDBOOK.



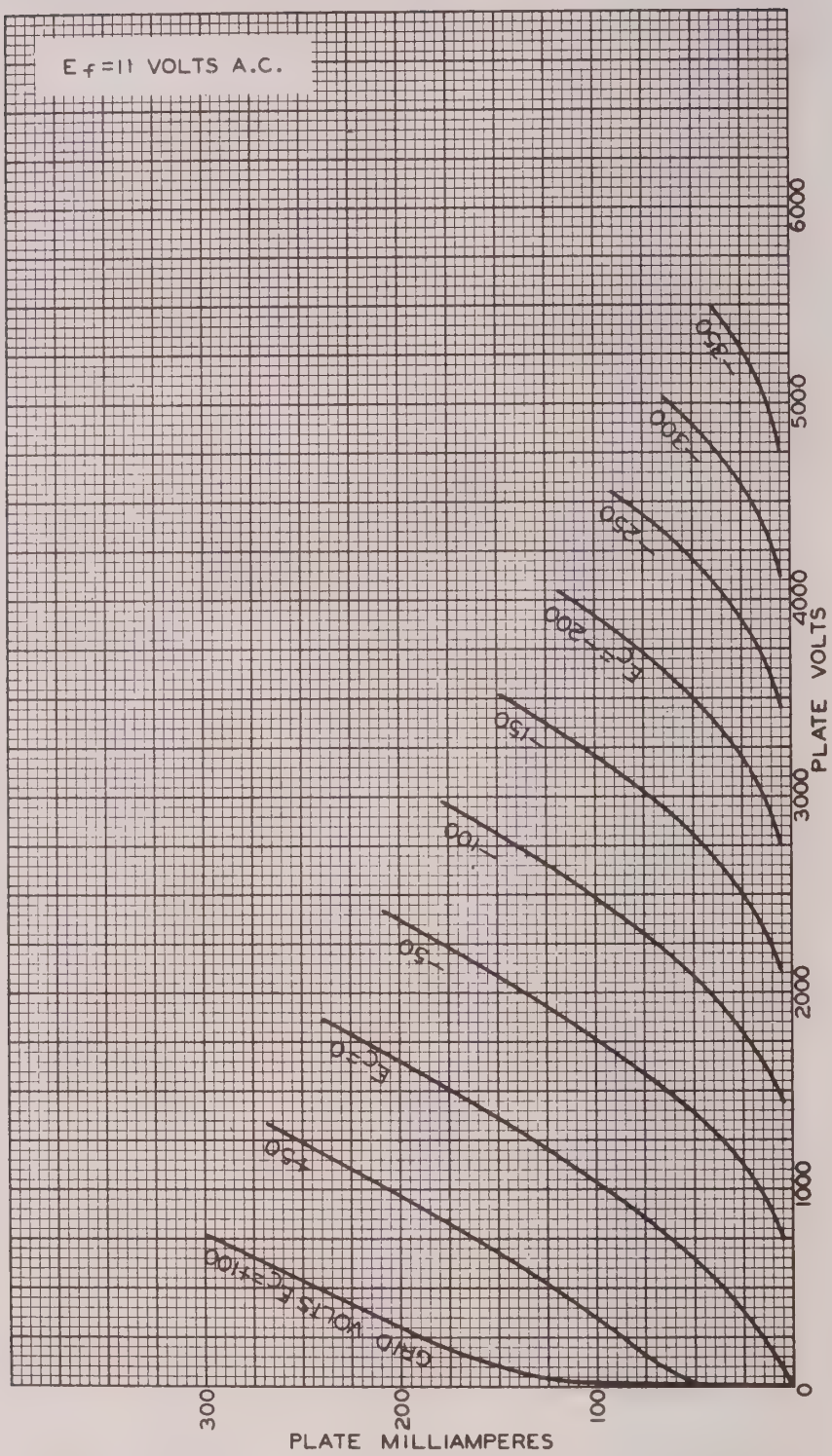

TUBE SYMBOL & CONNECTIONS TO END-MOUNTINGS



RCA

# 831

## AVERAGE PLATE CHARACTERISTICS



# 843

# POWER AMPLIFIER, OSCILLATOR

| | | |
|---|---|---|
| Heater | Coated Uni-potential Cathode* | |
| Voltage | 2.5 | a-c or d-c volts |
| Current | 2.5 | amp. |
| Amplification Factor | 7.7 | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 6 | μμf |
| Grid to Cathode | 5 | μμf |
| Plate to Cathode | 5 | μμf |
| Maximum Overall Length | | 5-5/8" |
| Maximum Diameter | | 2-3/16" |
| Bulb | | S-17 |
| Base | | Medium 5-Pin |

## A-F POWER AMPLIFIER - Class A

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 425 max. | volts |
| Plate Dissipation | | 12 max. | watts |
| Typical Operation: | | | |
| Heater Voltage* | 2.5 | 2.5 | volts |
| D-C Plate Voltage | 350 | 425 | volts |
| Grid Voltage | -25 | -35 | approx.volts |
| Peak Grid Swing | 25 | 35 | approx.volts |
| D-C Plate Current | 25 | 25 | ma. |
| Mutual Conductance | 1700 | 1600 | μmhos |
| Plate Resistance | 4700 | 4800 | ohms |
| Load Resistance | 9500 | 12000 | ohms |
| U.P.O. (5% second harmonic) | 0.95 | 1.6 | watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 450 max. | volts |
| D-C Plate Current | | 30 max. | ma. |
| Plate Dissipation | | 15 max. | watts |
| R-F Grid Current | | 4 max. | amp. |
| Typical Operation: | | | |
| Heater Voltage* | 2.5 | 2.5 | volts |
| D-C Plate Voltage | 350 | 450 | volts |
| Grid Voltage | -40 | -50 | approx.volts |
| D-C Plate Current | 25 | 25 | ma. |
| Peak Power Output | 8 | 12 | approx.watts |
| Carrier Power Output | 2 | 3 | approx.watts |

## PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0;*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 350 max. | volts |
| D-C Plate Current | | 40 max. | ma. |
| Plate Dissipation | | 10 max. | watts |
| R-F Grid Current | | 4 max. | amp. |
| D-C Grid Current | | 7.5 max. | ma. |
| Typical Operation: | | | |
| Heater Voltage* | 2.5 | 2.5 | volts |

*See next page.

# 843

# POWER AMPLIFIER, OSCILLATOR

(continued from preceding page)

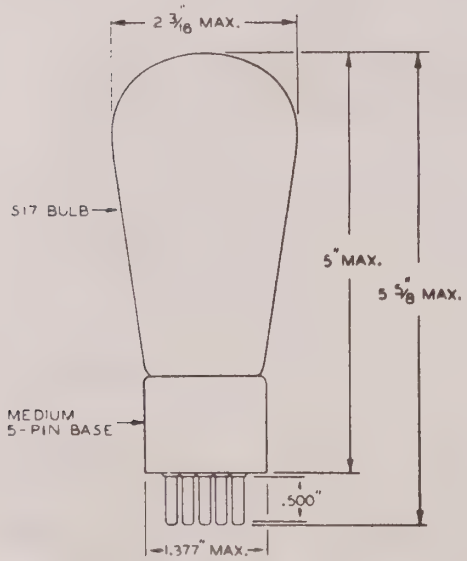
| | | | |
|---|---|---|---|
| D-C Plate Voltage | 250 | 350 | volts |
| Grid Voltage | -100 | -140 | approx.volts |
| D-C Plate Current | 30 | 30 | ma. |
| Power Output | 3 | 5 | approx.watts |

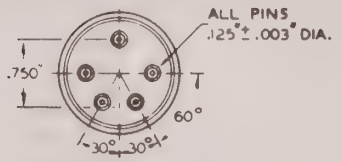
R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 450 max. | volts |
| D-C Plate Current | | 40 max. | ma. |
| Plate Dissipation | | 15 max. | watts |
| R-F Grid Current | | 5 max. | amp. |
| D-C Grid Current | | 7.5 max. | ma. |
| Typical Operation: | | | |
| Heater Voltage* | 2.5 | 2.5 | volts |
| D-C Plate Voltage | 350 | 450 | volts |
| Grid Voltage | -100 | -149 | approx.volts |
| D-C Plate Current | 30 | 30 | ma. |
| Power Output | 5 | 7.5 | approx.watts |

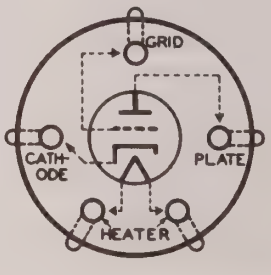
* Recommended practice is to connect the cathode directly to a mid-tap on the heater winding. If this practice is not followed, the potential difference between cathode and heater should be limited to 45 volts.




BOTTOM VIEW OF BASE

TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS



RCA

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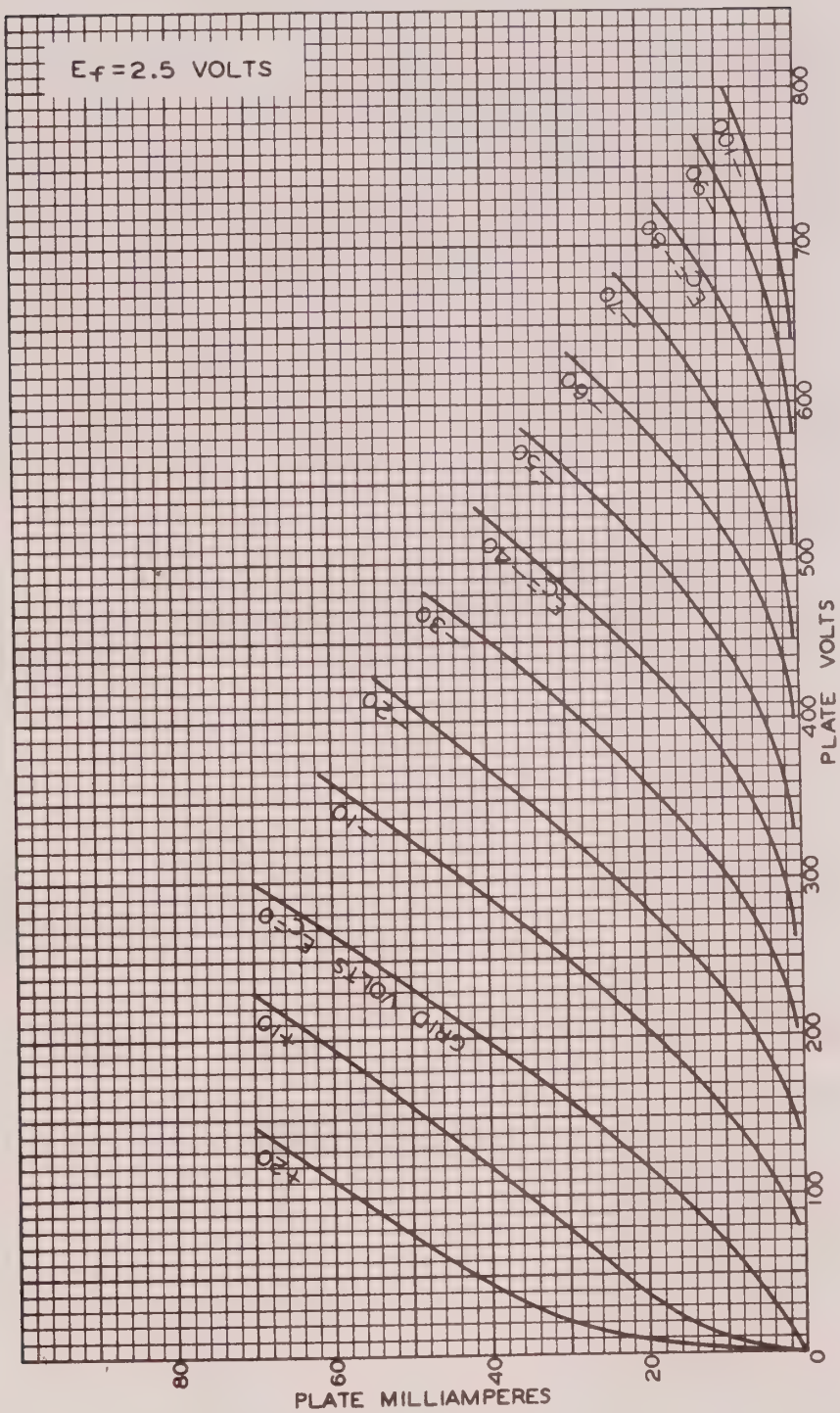
AVERAGE PLATE CHARACTERISTICS



# 844

# SCREEN GRID R-F POWER AMPLIFIER

| | | |
|---|---|---|
| Heater | Coated Uni-potential Cathode* | |
| Voltage | 2.5 | a-c or d-c volts |
| Current | 3.25 | amp. |
| Amplification Factor | 75 | |
| Mutual Conductance for plate current of 13 ma. | 600 μmhos | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 0.15 maximum | μμf |
| Input | 9.5 | μμf |
| Output | 7.5 | μμf |
| Overall Length | | 5-9/16" to 5-13/16" |
| Maximum Diameter | | 2-1/16" |
| Bulb | | ST-16 |
| Cap | | Medium Metal |
| Base | | Medium 5-Pin |

R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 500 max. | volts |
| D-C Plate Current | | 25 max. | ma. |
| Plate Dissipation | | 15 max. | watts |
| Screen Dissipation | | 3 max. | watts |
| R-F Grid Current | | 1 max. | amp. |
| Typical Operation: | | | |
| Heater Voltage* | 2.5 | 2.5 | volts |
| D-C Plate Voltage | 400 | 500 | volts |
| Screen Voltage | 180 | 180 | approx.volts |
| Grid Voltage | -40 | -40 | approx.volts |
| D-C Plate Current | 20 | 20 | ma. |
| Peak Power Output | 9.6 | 12 | approx.watts |
| Carrier Power Output | 2.4 | 3 | approx.watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions: for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 500 max. | volts |
| D-C Plate Current | | 25 max. | ma. |
| Plate Dissipation | | 10 max. | watts |
| Screen Dissipation | | 2 max. | watts |
| R-F Grid Current | | 1 max. | amp. |
| D-C Grid Current | | 5 max. | ma. |
| Typical Operation: | | | |
| Heater Voltage* | 2.5 | 2.5 | volts |
| D-C Plate Voltage | 400 | 500 | volts |
| Screen Voltage | 125 | 150 | approx.volts |
| Grid Voltage | -100 | -100 | approx.volts |
| D-C Plate Current | 20 | 20 | ma. |
| Power Output | 2 | 4 | approx.watts |

* See next page.

# 844

# SCREEN GRID R-F POWER AMPLIFIER

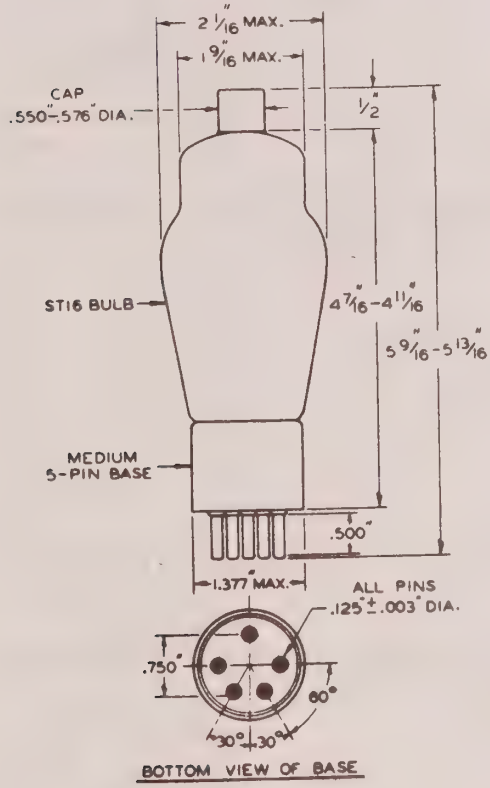
(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

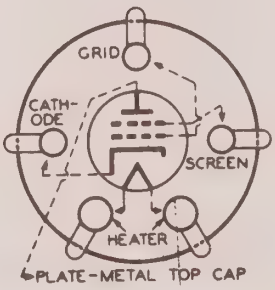
*(Key-down Conditions)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 500 max. | volts |
| D-C Plate Current | | 30 max. | ma. |
| Plate Dissipation | | 15 max. | watts |
| Screen Dissipation | | 3 max. | watts |
| R-F Grid Current | | 2 max. | amp. |
| D-C Grid Current | | 5 max. | ma. |
| Typical Operation: | | | |
| Heater Voltage* | 2.5 | 2.5 | volts |
| D-C Plate Voltage | 400 | 500 | volts |
| Screen Voltage | 175 | 175 | approx. volts |
| Grid Voltage | -125 | -125 | approx. volts |
| D-C Plate Current | 25 | 25 | ma. |
| Power Output | 6 | 9 | approx. watts |

* Recommended practice is to connect the cathode directly to a mid-tap on the heater winding. If this practice is not followed, the potential difference between cathode and heater should be limited to 45 volts.




TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS



# 846

# OSCILLATOR, R-F POWER AMPLIFIER

(WATER COOLED)

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 11 | a-c or d-c volts |
| Current | 51 | amp. |
| Amplification Factor | 40 | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 9.0 | μμf |
| Grid to Filament | 6.5 | μμf |
| Plate to Filament | 1.5 | μμf |
| Maximum Overall Length | | 9-1/2" |
| Maximum Radius | | 3-3/8" |
| Bulb | | T-20 with arm |
| Base | | None |
| Water Jacket | | Special |

R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 7500 max. | volts |
| D-C Plate Current | 0.5 max. | amp. |
| Plate Dissipation | 2500 max. | watts |
| R-F Grid Current | 30 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 7000 | volts |
| Grid Voltage | -150 approx. | volts |
| D-C Plate Current | 0.45 | amp. |
| Peak Power Output | 4000 approx. | watts |
| Nominal Carrier Power Output | 1000 | watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 6000 max. | volts |
| D-C Plate Current | 0.5 max. | amp. |
| Plate Dissipation | 1660 max. | watts |
| R-F Grid Current | 20 max. | amp. |
| D-C Grid Current | 0.1 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 5400 | volts |
| Grid Voltage | -400 approx. | volts |
| Nominal Power Output | 1400 | watts |

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | |
|---|---|---|
| D-C Plate Voltage | 7500 max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 2500 max. | watts |
| R-F Grid Current | 30 max. | amp. |

# 846

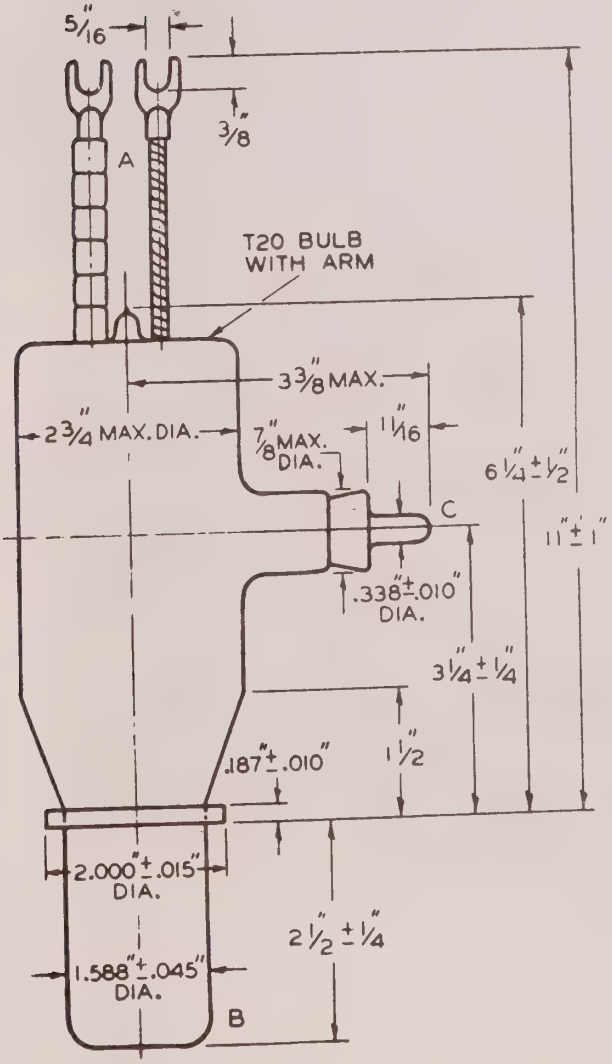
# OSCILLATOR, R-F POWER AMPLIFIER

(continued from preceding page)

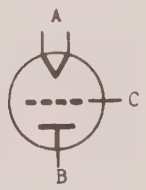
| | | |
|---|---|---|
| D-C Grid Current | 0.15 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 6750 | volts |
| Grid Voltage | -200 approx. | volts |
| Nominal Power Output | 3600 | watts |

**NOTE:** Regardless of the type of service in which the 846 is used, the maximum ratings apply only for single-tube operation at frequencies below 50 megacycles ( wavelengths above 6 meters). For operation at higher frequencies, refer to TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY in front part of HANDBOOK.

When two or more 846's are used in parallel, the plate voltage and output should be reduced. The amount of reduction depends on the number of tubes paralleled as well as the type of circuit and service contemplated.

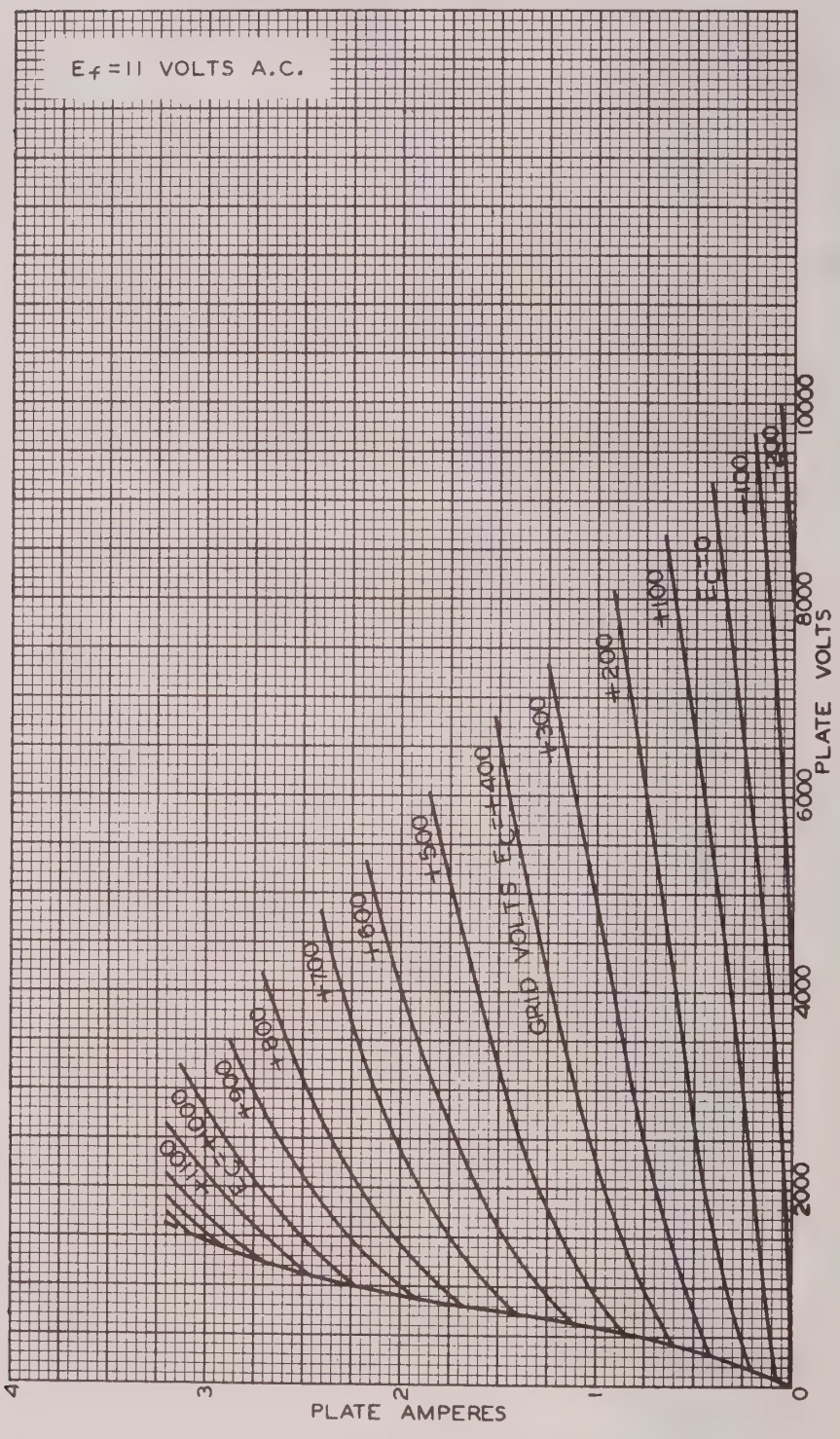



TUBE SYMBOL AND TERMINAL CONNECTIONS




A - Filament
B - Plate
C - Grid

# AVERAGE PLATE CHARACTERISTICS



# 848

# OSCILLATOR, R-F POWER AMPLIFIER, MODULATOR

(WATER COOLED)

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 22 | a-c or d-c volts |
| Current | 52 | amp. |
| Amplification Factor | 8 | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 27 | μμf |
| Grid to Filament | 18 | μμf |
| Plate to Filament | 2 | μμf |
| Maximum Overall Length | | 20-1/4" |
| Maximum Radius | | 6-1/2" |
| Bulb | | T-32 with arm |
| Base | | No. 3906 |
| Water Jacket | | UT-1285 |

## A-F POWER AMPLIFIER & MODULATOR - Class A

| | | |
|---|---|---|
| D-C Plate Voltage | 12000 max. | volts |
| Plate Dissipation | 7500 max. | watts |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 10000 | volts |
| Grid Voltage | -1040 approx. | volts |
| Peak Grid Swing | 1030 approx. | volts |
| D-C Plate Current | 0.65 | amp. |
| Load Resistance | 11500 | ohms |
| U.P.O.( 5% second harmonic) | 1930 | watts |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 15000 max. | volts |
| D-C Plate Current | Averaged over any audio-frequency cycle | 2.0 max. | amp. |
| Plate Dissipation | | 10000 max. | watts |
| Plate Input | | 25000 max. | watts |
| Typical Operation (2 tubes): | | | |
| Filament Voltage | | 22 | a-c volts |
| D-C Plate Voltage | | 12000 | volts |
| Grid Voltage | | -1600 approx. | volts |
| Zero-Signal Plate Cur. (per tube) | | 0.1 | amp. |
| Max.-Signal Plate Cur. (per tube) | | 1.8 | amp. |
| Nominal Power Output (2 tubes) | | 27500 | watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 15000 max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 10000 max. | watts |
| R-F Grid Current | 20 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 13500 | volts |

848

# OSCILLATOR, R-F POWER AMPLIFIER, MODULATOR

(continued from preceding page)

| | | | |
|---|---|---|---|
| Grid Voltage | -1900 | approx. | volts |
| D-C Plate Current | 0.9 | | amp. |
| Peak Power Output | 16000 | approx. | watts |
| Nominal Carrier Power Output | 4000 | | watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 10000 | max. | volts |
| D-C Plate Current | 1.0 | max. | amp. |
| Plate Dissipation | 6600 | max. | watts |
| R-F Grid Current | 20 | max. | amp. |
| D-C Grid Current | 0.2 | max. | amp. |
| Typical Operation: | | | |
| Filament Voltage | 22 | a-c | volts |
| D-C Plate Voltage | 9000 | | volts |
| Grid Voltage | -4000 | approx. | volts |
| Nominal Power Output | 6000 | | watts |

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 15000 | max. | volts |
| D-C Plate Current | 2.0 | max. | amp. |
| Plate Dissipation | 10000 | max. | watts |
| R-F Grid Current | 30 | max. | amp. |
| D-C Grid Current | 0.2 | max. | amp. |
| Typical Operation: | | | |
| Filament Voltage | 22 | a-c | volts |
| D-C Plate Voltage | 12000 | | volts |
| Grid Voltage | -5000 | approx. | volts |
| Nominal Power Output | 15000 | | watts |

NOTE: Regardless of the type of service in which the 848 is used, the maximum ratings apply only for single-tube operation at frequencies below 1.5 megacycles ( wavelengths above 200 meters). For operation at higher frequencies, refer to TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY in front part of HANDBOOK.

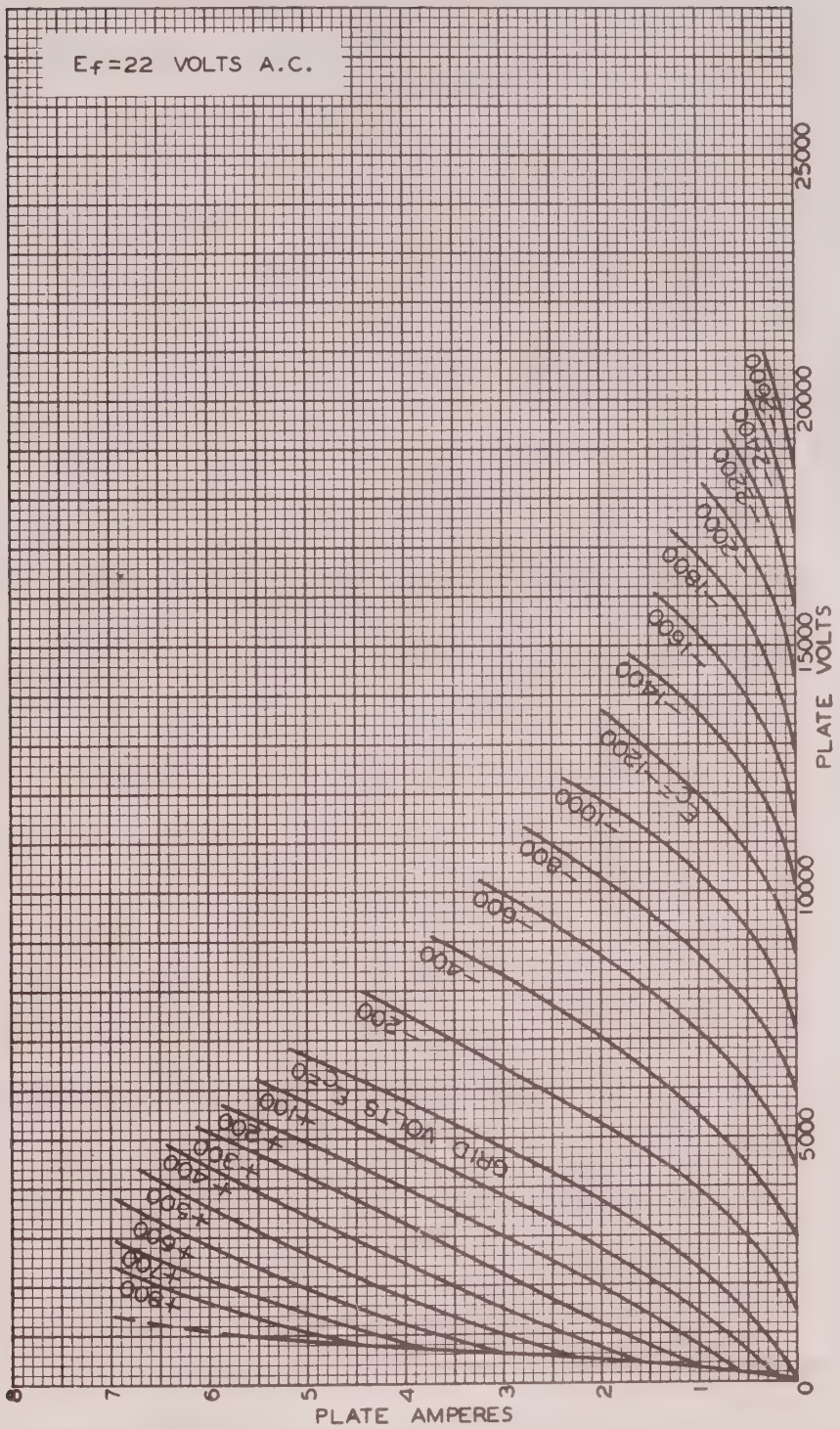
When two or mor 848's are used in parallel, the plate voltage and output should be reduced. The amount of reduction depends on the number of tubes paralleled as well as the type of circuit and service contemplated.

OUTLINE DIMENSIONS, TUBE SYMBOL, and TERMINAL CONNECTIONS for the 848 are the same as for the 207.

RCA

848

## AVERAGE PLATE CHARACTERISTICS



850

# SCREEN GRID R-F POWER AMPLIFIER

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 10 | a-c or d-c volts |
| Current | 3.25 | amp. |
| Amplification Factor | 550 approx. | |
| Mutual Conductance for plate current of 19.5 ma. | 2750 μmhos | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 0.25 maximum | μμf |
| Input | 17 | μμf |
| Output | 25 | μμf |
| Maximum Overall Length | | 8-1/2" |
| Maximum Diameter | | 2-5/16" |
| Bulb | | T-18 |
| Cap | | Medium Metal |
| Base | | Jumbo 4-Large Pin |

R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 1250 max. | volts |
| D-C Plate Current | | 150 max. | ma. |
| Plate Dissipation | | 100 max. | watts |
| Screen Dissipation | | 10 max. | watts |
| R-F Grid Current | | 6 max. | amp. |
| Typical Operation: | | | |
| Filament Voltage | 10 | 10 | a-c volts |
| D-C Plate Voltage | 1000 | 1250 | volts |
| Screen Voltage | 175 | 175 | approx.volts |
| Grid Voltage | -13 | -13 | approx.volts |
| D-C Plate Current | 100 | 110 | ma. |
| Peak Power Output | 120 | 160 | approx.watts |
| Carrier Power Output | 30 | 40 | approx.watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 1000 max. | volts |
| D-C Plate Current | | 150 max. | ma. |
| Plate Dissipation | | 70 max. | watts |
| Screen Dissipation | | 7 max. | watts |
| R-F Grid Current | | 6 max. | amp. |
| D-C Grid Current | | 40 max. | ma. |
| Typical Operation: | | | |
| Filament Voltage | 10 | 10 | a-c volts |
| D-C Plate Voltage | 750 | 1000 | volts |
| Screen Voltage | 125 | 140 | approx.volts |
| Grid Voltage | -100 | -100 | approx.volts |
| D-C Plate Current | 140 | 125 | ma. |
| Power Output | 50 | 65 | approx.watts |

RCA

850

# SCREEN GRID R-F POWER AMPLIFIER

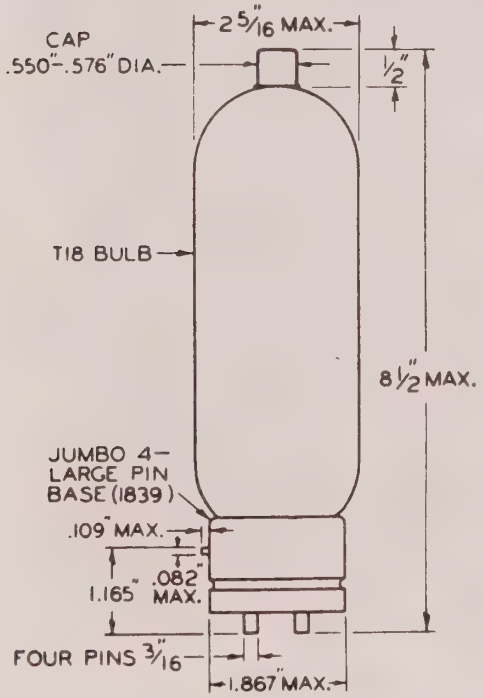
(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

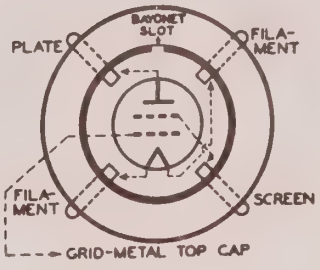
*(Key-down Conditions)*

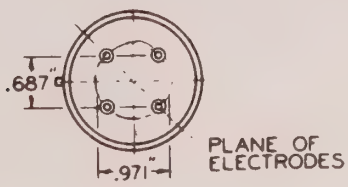
| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 1250 max. | volts |
| D-C Plate Current | | | 175 max. | ma. |
| Plate Dissipation | | | 100 max. | watts |
| Screen Dissipation | | | 10 max. | watts |
| R-F Grid Current | | | 7.5 max. | amp. |
| D-C Grid Current | | | 40 max. | ma. |
| Typical Operation: | | | | |
| Filament Voltage | 10 | 10 | 10 | a-c volts |
| D-C Plate Voltage | 750 | 1000 | 1250 | volts |
| Screen Voltage | 175 | 175 | 175 | approx.volts |
| Grid Voltage | -150 | -150 | -150 | approx.volts |
| D-C Plate Current | 160 | 160 | 160 | ma. |
| Power Output | 55 | 100 | 130 | approx.watts |

**NOTE:** Regardless of the type of service in which the 850 is used, the maximum ratings apply only for operation at frequencies below approximately 13 megacycles ( wavelengths above 23.6 meters ). For operation at higher frequencies, refer to the sheet on TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY.




TUBE SYMBOL & TOP VIEW
OF
SOCKET CONNECTIONS



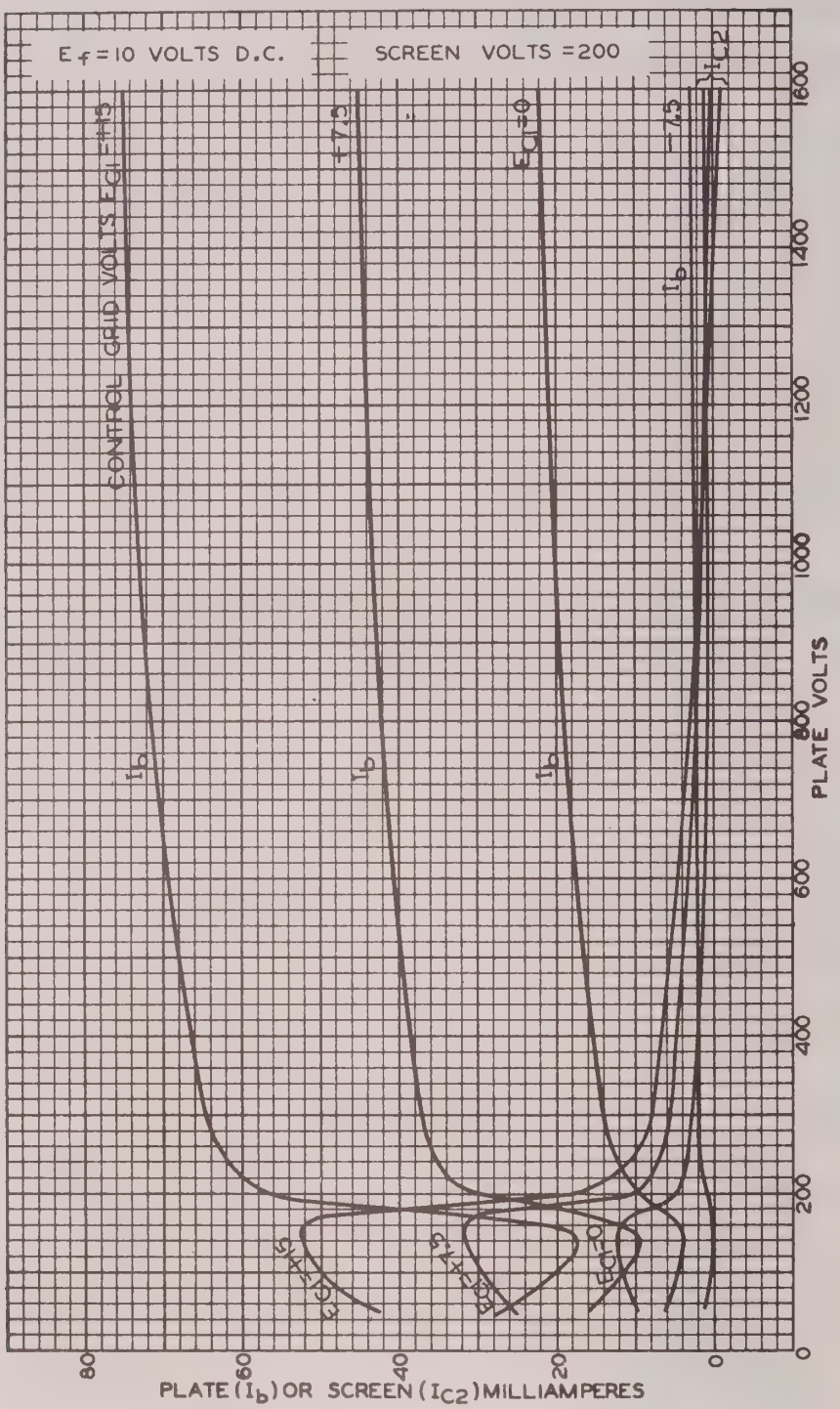




BOTTOM VIEW OF BASE

RCA

850

## AVERAGE PLATE CHARACTERISTICS



RCA

# 851

# MODULATOR, A-F POWER AMPLIFIER, R-F POWER AMPLIFIER, OSCILLATOR

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 11 | a-c or d-c volts |
| Current | 15.5 | amp. |
| Amplification Factor | 20.5 | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 47 | μμf |
| Grid to Filament | 25.5 | μμf |
| Plate to Filament | 4.5 | μμf |
| Overall Length | | 17-1/2"±1/8" |
| Maximum Diameter | | 6-1/8" |
| Bulb | | T-48 |
| Cap | | No. 1902 |
| Base | | No. 3504 |

## A-F POWER AMPLIFIER & MODULATOR - Class A

| | | |
|---|---|---|
| D-C Plate Voltage | 2500 max. | volts |
| Plate Dissipation | 600 max. | watts |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 2000 | volts |
| Grid Voltage | -65 | volts |
| Peak Grid Swing | 60 | volts |
| D-C Plate Current | 270 | ma. |
| Load Resistance | 3100 | ohms |
| U.P.O. ( 5% second harmonic) | 100 | watts |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | |
|---|---|---|
| D-C Plate Voltage | 3000 max. | volts |
| D-C Plate Current (Averaged over any audio-frequency cycle) | 1.0 max. | amp. |
| Plate Dissipation (Averaged over any audio-frequency cycle) | 750 max. | watts |
| Plate Input (Averaged over any audio-frequency cycle) | 2250 max. | watts |

Typical Operation (2 tubes):

| | | | | |
|---|---|---|---|---|
| Filament Voltage | 11 | 11 | 11 | a-c volts |
| D-C Plate Voltage | 2000 | 2500 | 3000 | volts |
| Grid Voltage | -85 | -111 | -135 | approx. volts |
| Zero-Sig. Plate Cur. (per tube) | 60 | 60 | 55 | ma. |
| Max.-Sig. Plate Cur. (per tube) | 850 | 680 | 570 | ma. |
| Load Resistance (per tube) | 650 | 1020 | 1480 | ohms |
| Effective Load Res. (plate to plate) | 2600 | 4080 | 5920 | ohms |
| Power Output ( 2 tubes ) | 2200 | 2200 | 2200 | approx. watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 2500 max. | volts |
| D-C Plate Current | 750 max. | ma. |
| Plate Dissipation | 750 max. | watts |
| R-F Grid Current | 8 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |

# MODULATOR, A-F POWER AMPLIFIER, R-F POWER AMPLIFIER, OSCILLATOR

(continued from preceding page)

| | | |
|---|---|---|
| D-C Plate Voltage | 2000 | volts |
| Grid Voltage | -85 approx. | volts |
| D-C Plate Current | 475 | ma. |
| Peak Power Output | 1200 approx. | watts |
| Carrier Power Output | 300 approx. | watts |

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 2000 max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 500 max. | watts |
| R-F Grid Current | 8 max. | amp. |
| D-C Grid Current | 200 max. | ma. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 1800 | volts |
| Grid Voltage | -350 approx. | volts |
| D-C Plate Current | 450 | ma. |
| Power Output | 1000 approx. | watts |

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

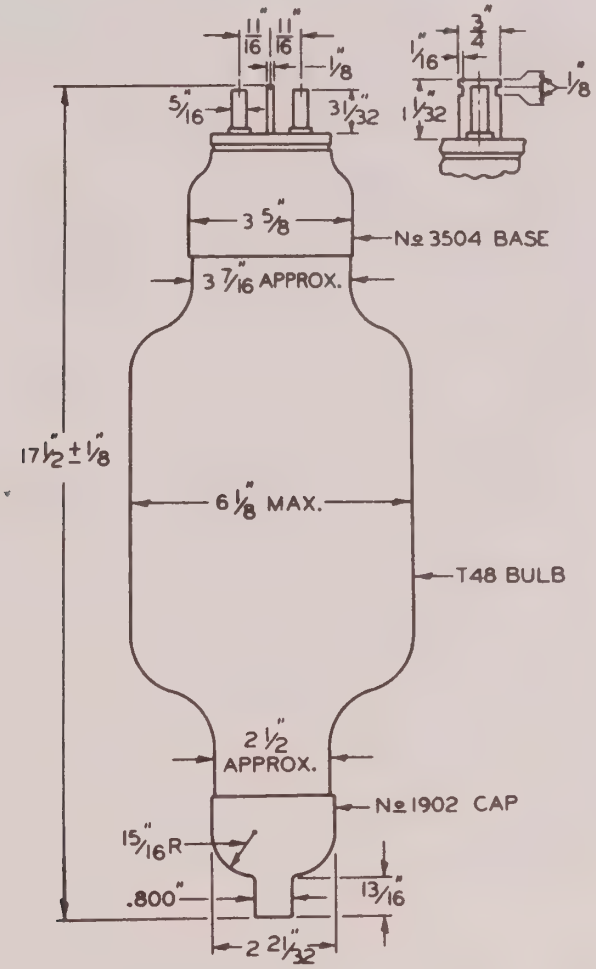
*(Key-down Conditions)*

| | | |
|---|---|---|
| D-C Plate Voltage | 2500 max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 750 max. | watts |
| R-F Grid Current | 10 max. | amp. |
| D-C Grid Current | 200 max. | ma. |
| Typical Operation: | | |
| Filament Voltage | 11 | a-c volts |
| D-C Plate Voltage | 2000 | volts |
| Grid Voltage | -200 approx. | volts |
| D-C Plate Current | 900 | ma. |
| Power Output | 1250 approx. | watts |

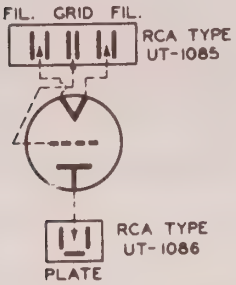
# 851

# MODULATOR, A-F POWER AMPLIFIER, R-F POWER AMPLIFIER, OSCILLATOR

(continued from preceding page)



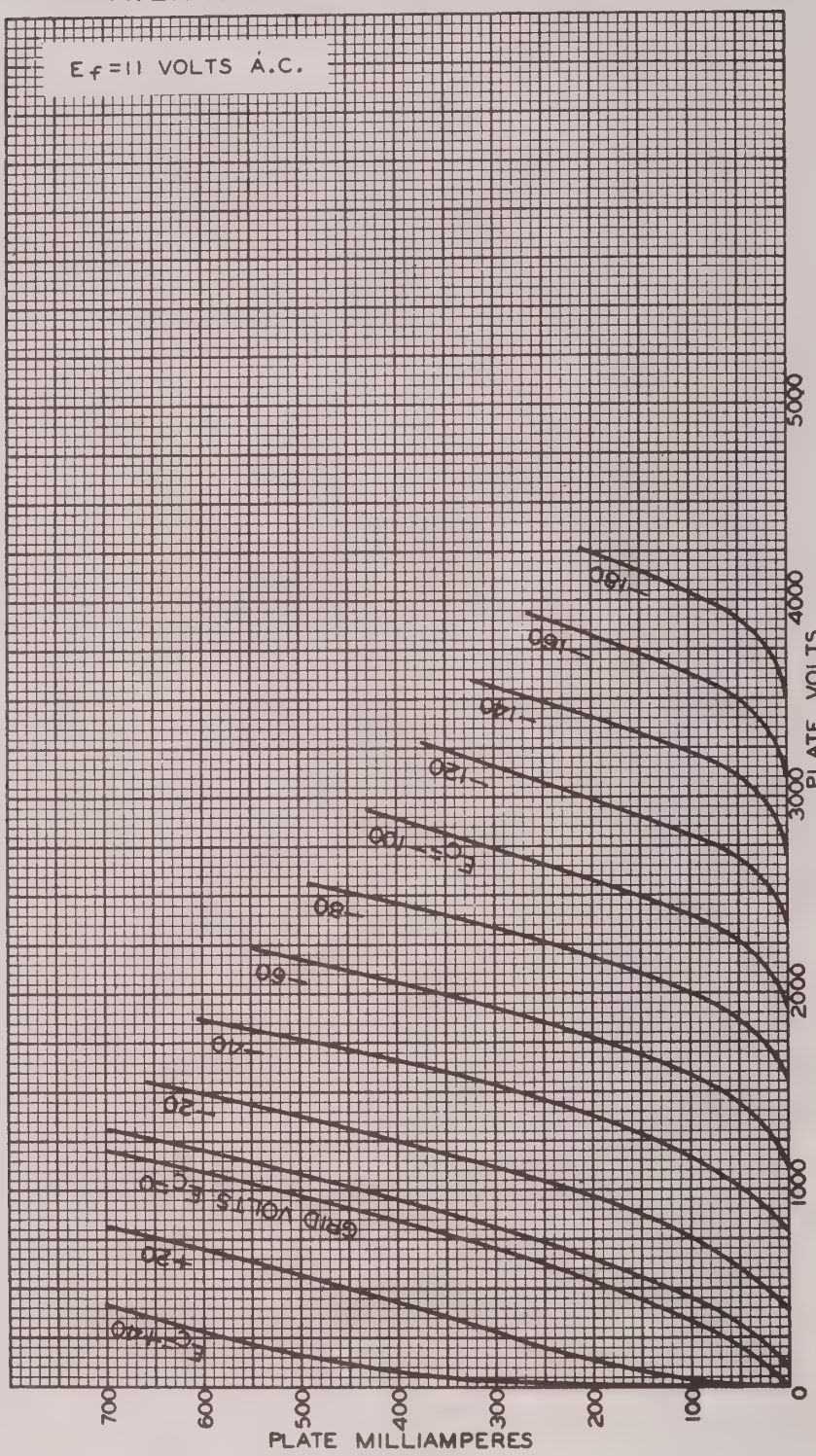

TUBE SYMBOL & CONNECTIONS TO END-MOUNTINGS



RCA

851

# AVERAGE PLATE CHARACTERISTICS



# 857

# HALF-WAVE MERCURY-VAPOR RECTIFIER

| | | |
|---|---|---|
| Heater | Coated Uni-potential Cathode* | |
| Voltage | 5 | a-c volts |
| Current | 30 | amp. |
| Overall Length | | 19-1/2" ± 3/8" |
| Maximum Diameter | | 7-1/8" |
| Bulb | | GT-56 |
| Cap | | No. 1904 |
| Base# | | No. 3911 |

Peak Inverse Voltage:

| *Supply Freq.* | *Ambient Temp. Range* | |
|---|---|---|
| Up to 150~ | 15° - 50°C | 10000 max. volts |
| Up to 150~ | 30° - 40°C | 22000 max.** volts |
| Peak Plate Current | | 40 max. amp. |
| Average Plate Current | | 10 max. amp. |
| Tube Voltage Drop | | 10 approx. volts |

* The cathode should be allowed to come up to operating temperature before plate voltage is applied. For average conditions, the delay is approximately 10 minutes.

\# Base shell is connected within base to cathode lead.

** For plate potentials in excess of 10000 volts peak inverse, temperature-regulated forced-air cooling must be employed.

For *shielding and r-f filter circuits*, refer to Type 871.

The table below classifies suitable rectifier circuits for the 857 and shows their safe maximum input and maximum output operating conditions for a peak inverse voltage of 22000 volts. The values are based on sine-wave input and the use of a pure resistance load. If the 857 is to be used under temperature conditions such that the peak inverse voltage is limited to 10000 volts, the a-c input voltage and d-c output voltage values in the table should be multiplied by a factor of 0.45 to give the maximum values for the 10000-volt conditions.

*Circuits are shown on 2nd following page.*

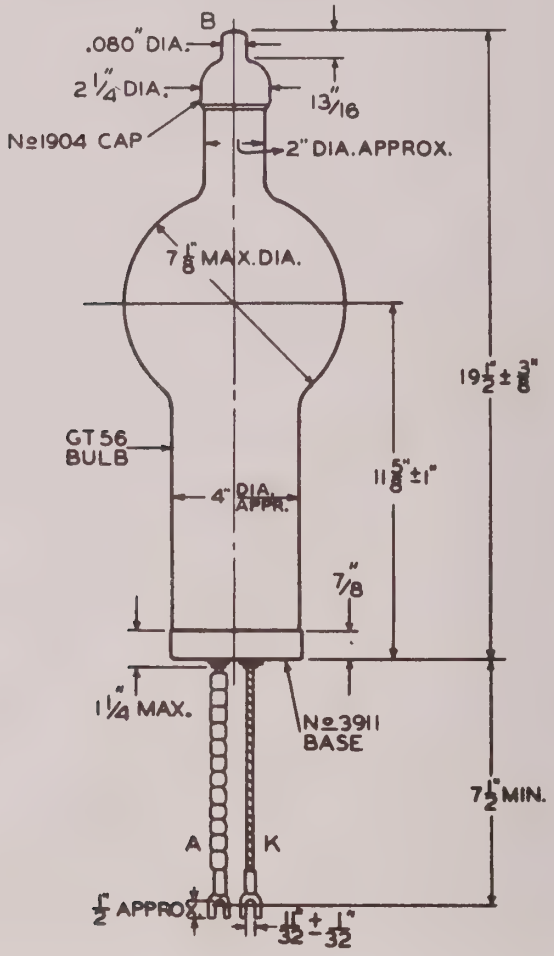
| CIRCUIT | MAXIMUM A-C INPUT VOLTS* (RMS) | APPROX. D-C OUTPUT VOLTS TO FILTER | MAXIMUM D-C LOAD CURRENT amperes |
|---|---|---|---|
| SINGLE-PHASE FULL-WAVE (2 tubes) FIG. 1 | 7750 per tube | 7000 | 20 |
| SINGLE-PHASE FULL-WAVE (4 tubes) FIG. 2 | 15500 total | 14000 | 20 |
| THREE-PHASE HALF-WAVE FIG. 3 | 9000 per leg | 10500 | 30 |
| THREE-PHASE DOUBLE-Y PARALLEL FIG. 4 | 9000 per leg | 10500 | 60 |
| THREE-PHASE FULL-WAVE FIG. 5 | 9000 per leg | 21000 | 30 |

* For maximum peak inverse voltage of 22000 volts.

# 857

# HALF-WAVE MERCURY-VAPOR RECTIFIER

(continued from preceding page)




TUBE SYMBOL
AND
TERMINAL CONNECTIONS

A - Heater
K - Cathode & Heater
B - Plate

NOTE: Special end-mountings are required.

# CIRCUITS FOR HOT-CATHODE MERCURY-VAPOR RECTIFIER TUBES

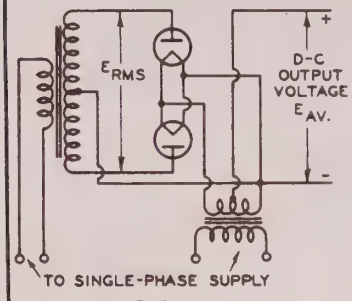



FIG. 1

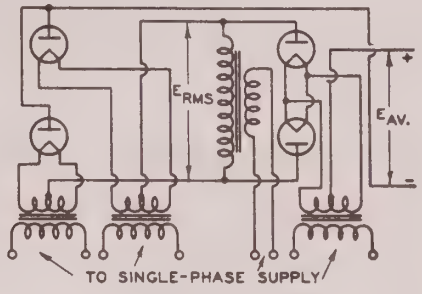



FIG. 2

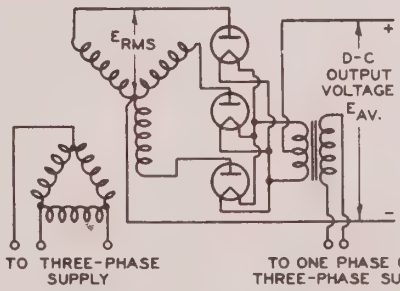



FIG. 3

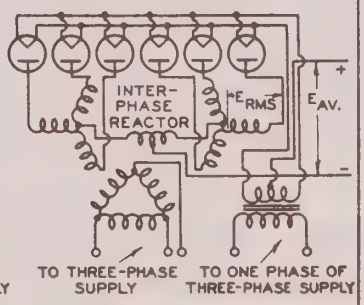



FIG. 4

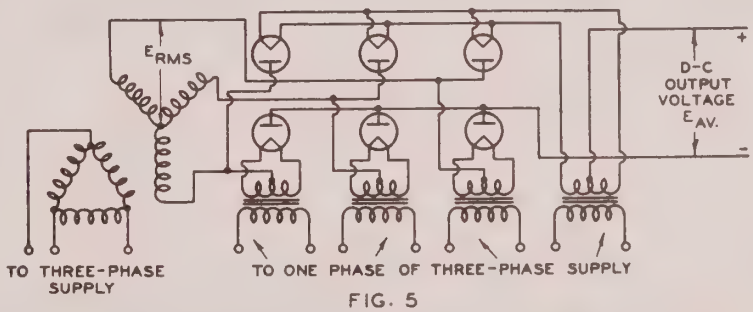



FIG. 5

| FIGURE | CIRCUIT | $E_{AVERAGE}$ | $E_{INVERSE}$ | $I_{AVERAGE}$ |
|---|---|---|---|---|
| 1 | SINGLE-PHASE FULL-WAVE (2 TUBES) | $0.318\,E_{MAXIMUM}$ $0.450\,E_{RMS}$ | $3.14\,E_{AVERAGE}$ | $0.636\,I_{MAXIMUM}$ |
| 2 | SINGLE-PHASE FULL-WAVE (4 TUBES) | $0.636\,E_{MAXIMUM}$ $0.900\,E_{RMS}$ | $1.57\,E_{AVERAGE}$ | $0.636\,I_{MAXIMUM}$ |
| 3 | THREE-PHASE HALF-WAVE | $0.827\,E_{MAXIMUM}$ $1.170\,E_{RMS}$ | $2.09\,E_{AVERAGE}$ | $0.827\,I_{MAXIMUM}$ |
| 4 | THREE-PHASE DOUBLE-Y PARALLEL | $0.827\,E_{MAXIMUM}$ $1.170\,E_{RMS}$ | $2.09\,E_{AVERAGE}$ | $1.91\,I_{MAXIMUM}$ |
| 5 | THREE-PHASE FULL-WAVE | $1.65\,E_{MAXIMUM}$ $2.34\,E_{RMS}$ | $1.045\,E_{AVERAGE}$ | $0.955\,I_{MAXIMUM}$ |

CONDITIONS ASSUMED :-

(1) SINE-WAVE SUPPLY (2) BALANCED PHASE VOLTAGES (3) ZERO TUBE DROP
(4) PURE RESISTANCE LOAD (5) NO FILTER USED

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# OSCILLATOR, R-F POWER AMPLIFIER

(WATER COOLED)

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 22 | a-c or d-c volts |
| Current | 52 | amp. |
| Amplification Factor | 42 | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 18 | μμf |
| Grid to Filament | 16 | μμf |
| Plate to Filament | 2 | μμf |
| Maximum Overall Length | | 24-1/2" |
| Maximum Radius | | 7-1/2" |
| Bulb | | T-40 with arm |
| Base | | None |
| Water Jacket | | UT-1290 |

R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 20000* max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 20000 max. | watts |
| R-F Grid Current | 40 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 18000 | volts |
| Grid Voltage | -350 approx. | volts |
| D-C Plate Current | 1.0 | amp. |
| Peak Power Output | 24000 approx. | watts |
| Nominal Carrier Power Output | 6000 | watts |

* This is the maximum safe plate voltage for this service when the 858 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). When 858's are used in parallel or at frequencies above 1500 kc, the plate voltage and output per tube should be decreased, and in addition the load should be balanced between tubes. For operation of the 858 at the higher frequencies, refer to TABLE I on next page.

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 16000** max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 13200 max. | watts |
| R-F Grid Current | 40 max. | amp. |
| D-C Grid Current | 0.25 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 14400 | volts |
| Grid Voltage | -3500 approx. | volts |
| Nominal Power Output | 10000 | watts |

** This is the maximum safe plate voltage for this service when the 858 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). The high a-c peaks encountered when modulating necessitate the use of reduced plate voltage and current as

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# OSCILLATOR, R-F POWER AMPLIFIER

(continued from preceding page)

compared with the unmodulated Class C service given below. For operation of the 858 at the higher frequencies, refer to TABLE II at the bottom of this page.

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | |
|---|---|---|
| D-C Plate Voltage | 20000° max. | volts |
| D-C Plate Current | 2.0 max. | amp. |
| Plate Dissipation | 20000 max. | watts |
| R-F Grid Current | 60 max. | amp. |
| D-C Grid Current | 0.25 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 a-c | volts |
| D-C Plate Voltage | 18000 | volts |
| Grid Voltage | -3500 approx. | volts |
| Nominal Power Output | 22000 | watts |

° This is the maximum safe plate voltage for this service when the 858 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). When 858's are operated in parallel or at frequencies above 1500 kc, the plate voltage and output per tube should be decreased, and in addition the load should be balanced between tubes. For operation of the 858 at the higher frequencies refer to TABLE III on next page.

TABLE I

*Carrier Conditions; for use with a Modulation Factor up to 1.0*

| FREQUENCY kc | MAX. D-C PLATE VOLTS | APPROX. GRID BIAS VOLTS | TYPICAL VALUES OF D-C PLATE AMP. | PLATE DISSIPATION WATTS | PEAK OUTPUT WATTS | CARRIER OUTPUT WATTS |
|---|---|---|---|---|---|---|
| 1500 | 20000 | -400 | 1.00 | 13500 | 26000 | 6500 |
| 10000 | 18000 | -350 | 1.00 | 12000 | 24000 | 6000 |
| 20000 | 15000 | -300 | 0.90 | 9000 | 18000 | 4500 |
| 30000 | 12500 | -225 | 0.85 | 7000 | 14000 | 3500 |
| 40000 | 10000 | -175 | 0.70 | 5000 | 9000 | 2250 |

TABLE II

*Carrier Conditions; for use with a Modulation Factor up to 1.0*

| FREQUENCY kc | MAX. D-C PLATE VOLTS | APPROX. GRID BIAS VOLTS | TYPICAL VALUES OF D-C PLATE AMPERES | POWER OUTPUT WATTS |
|---|---|---|---|---|
| 1500 | 16000 | -4000 | 1.0 | 10500 |
| 10000 | 14000 | -3500 | 1.0 | 9300 |
| 20000 | 12500 | -3100 | 1.0 | 8200 |
| 30000 | 10000 | -2500 | 1.0 | 6500 |
| 40000 | 8000 | -2000 | 1.0 | 5000 |

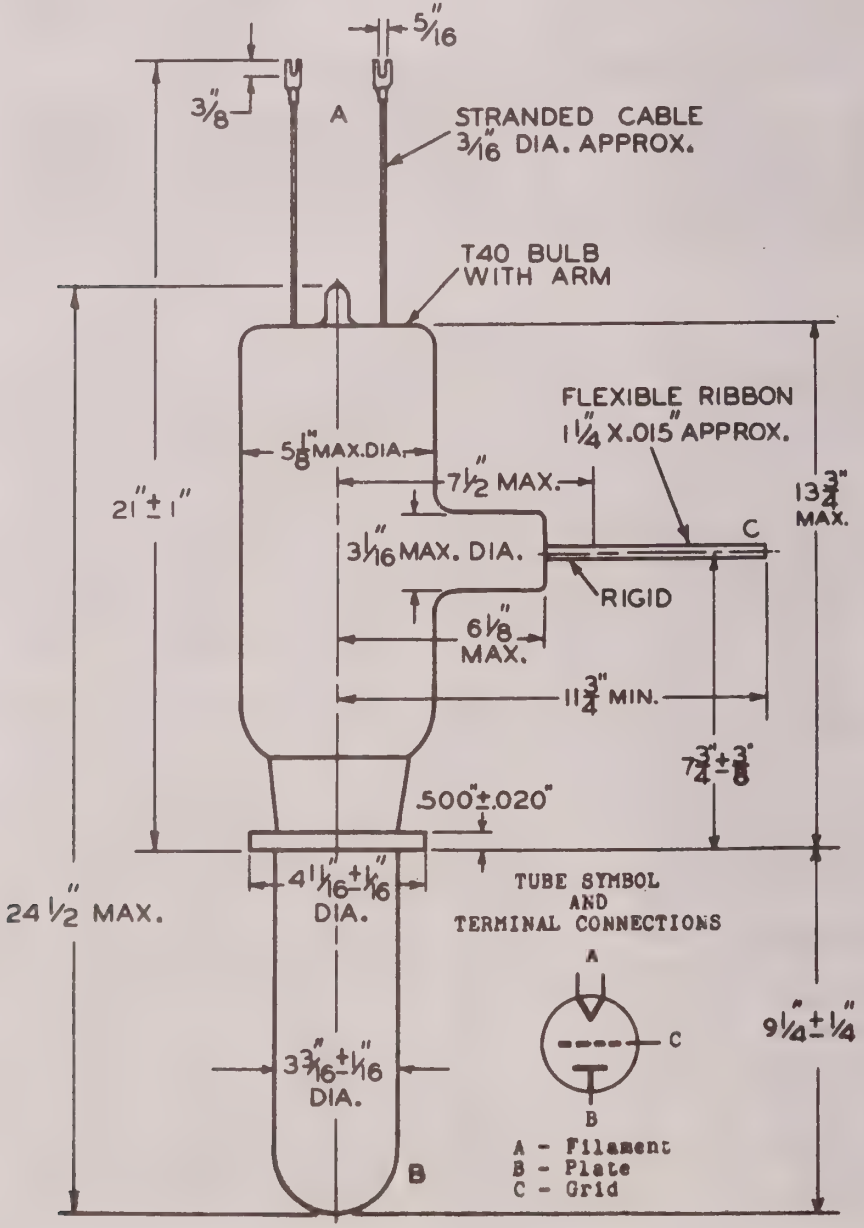
# 858

# OSCILLATOR, R-F POWER AMPLIFIER

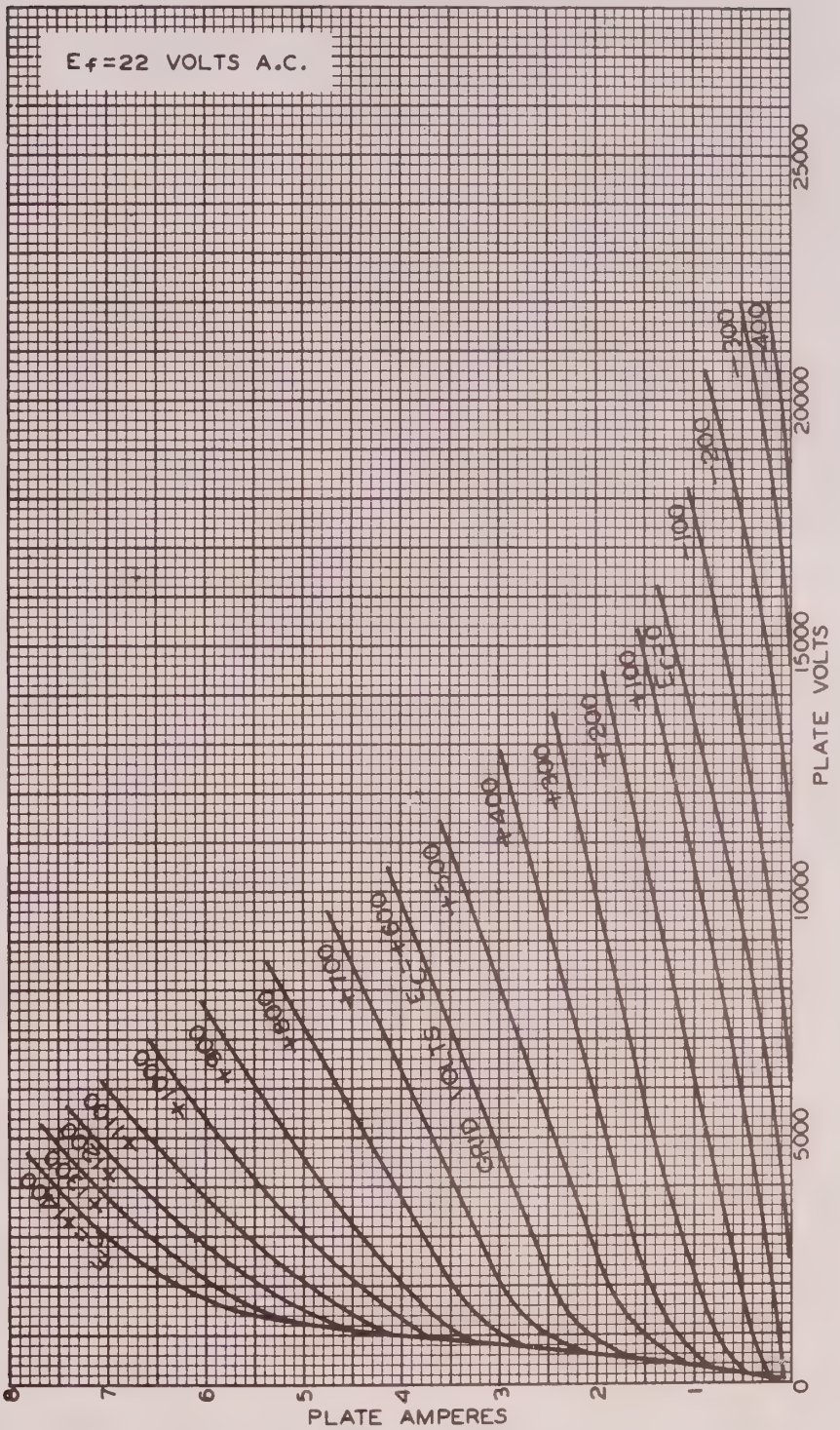
(continued from preceding page)

TABLE III

| *Key-down Conditions* | | | | |
|---|---|---|---|---|
| | MAX. | APPROX. | TYPICAL VALUES OF | |
| | D-C | GRID | D-C | POWER |
| FREQUENCY | PLATE | BIAS | PLATE | OUTPUT |
| kc | VOLTS | VOLTS | AMPERES | WATTS |
| 1500 | 20000 | -4000 | 1.8 | 25000 |
| 10000 | 18000 | -3500 | 1.8 | 22000 |
| 20000 | 15000 | -3000 | 1.8 | 18000 |
| 30000 | 12500 | -2500 | 1.7 | 14000 |
| 40000 | 10000 | -2000 | 1.4 | 9000 |



## AVERAGE PLATE CHARACTERISTICS



RCA

861

# SCREEN GRID R-F POWER AMPLIFIER

| | | | |
|---|---|---|---|
| Filament | Thoriated Tungsten | | |
| Voltage | 11 | | a-c or d-c volts |
| Current | 10 | | amp. |
| Amplification Factor | 300 | approx. | |
| Mutual Conductance for plate current of 130 ma. | 2100 | μmhos | |
| Direct Interelectrode Capacitances: | | | |
| Grid to Plate | 0.10 | maximum | μμf |
| Input | 14.5 | | μμf |
| Output | 10.5 | | μμf |
| Overall Length | | | 17-3/32"±1/8" |
| Maximum Radius | | | 6-5/8" |
| Bulb | | | GT-56 with arm |
| Cap ( opposite filament base ) | | | No. 3909 |
| Cap ( on side of bulb ) | | | No. 3910 |
| Base | | | No. 3503 |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 3500 | max. | volts |
| D-C Plate Current | 250 | max. | ma. |
| Plate Dissipation | 400 | max. | watts |
| Screen Dissipation | 35 | max. | watts |
| R-F Grid Current | 7 | max. | amp. |

| Typical Operation: | | | | |
|---|---|---|---|---|
| Filament Voltage | 11 | 11 | a-c | volts |
| D-C Plate Voltage | 3000 | 3500 | | volts |
| Screen Voltage | 500 | 500 | approx. | volts |
| Grid Voltage | -60 | -60 | approx. | volts |
| D-C Plate Current | 167 | 146 | | ma. |
| Peak Power Output | 600 | 640 | | watts |
| Nominal Carrier Power Output | 150 | 160 | | watts |

## PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 3000 | max. | volts |
| D-C Plate Current | 300 | max. | ma. |
| Plate Dissipation | 270 | max. | watts |
| Screen Dissipation | 23 | max. | watts |
| R-F Grid Current | 7 | max. | amp. |
| D-C Grid Current | 75 | max. | ma. |

| Typical Operation: | | | | | |
|---|---|---|---|---|---|
| Filament Voltage | 11 | 11 | 11 | a-c | volts |
| D-C Plate Voltage | 2000 | 2500 | 3000 | | volts |
| Screen Voltage | 350 | 400 | 500 | approx. | volts |
| Grid Voltage | -200 | -250 | -300 | approx. | volts |
| D-C Plate Current | 265 | 225 | 200 | | ma. |
| Nominal Power Output | 285 | 320 | 360 | | watts |

# 861

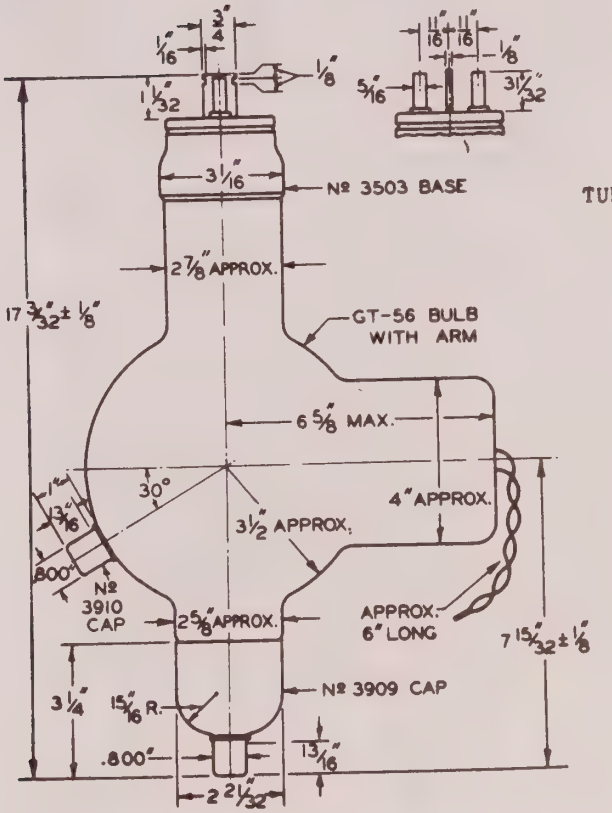
# SCREEN GRID R-F POWER AMPLIFIER

(continued from preceding page)

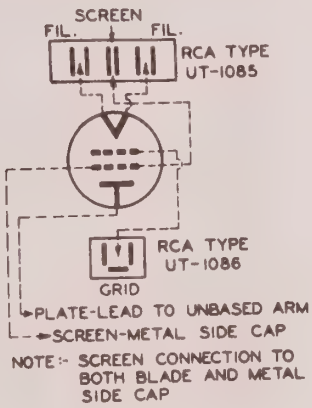
R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 3500 max. | volts |
| D-C Plate Current | | | 350 max. | ma. |
| Plate Dissipation | | | 400 max. | watts |
| Screen Dissipation | | | 35 max. | watts |
| R-F Grid Current | | | 10 max. | amp. |
| D-C Grid Current | | | 75 max. | ma. |
| Typical Operation: | | | | |
| Filament Voltage | 11 | 11 | 11 | a-c volts |
| D-C Plate Voltage | 2000 | 3000 | 3500 | volts |
| Screen Voltage | 350 | 500 | 600 | approx. volts |
| Grid Voltage | -150 | -200 | -250 | approx. volts |
| D-C Plate Current | 300 | 300 | 275 | ma. |
| Nominal Power Output | 325 | 540 | 590 | watts |

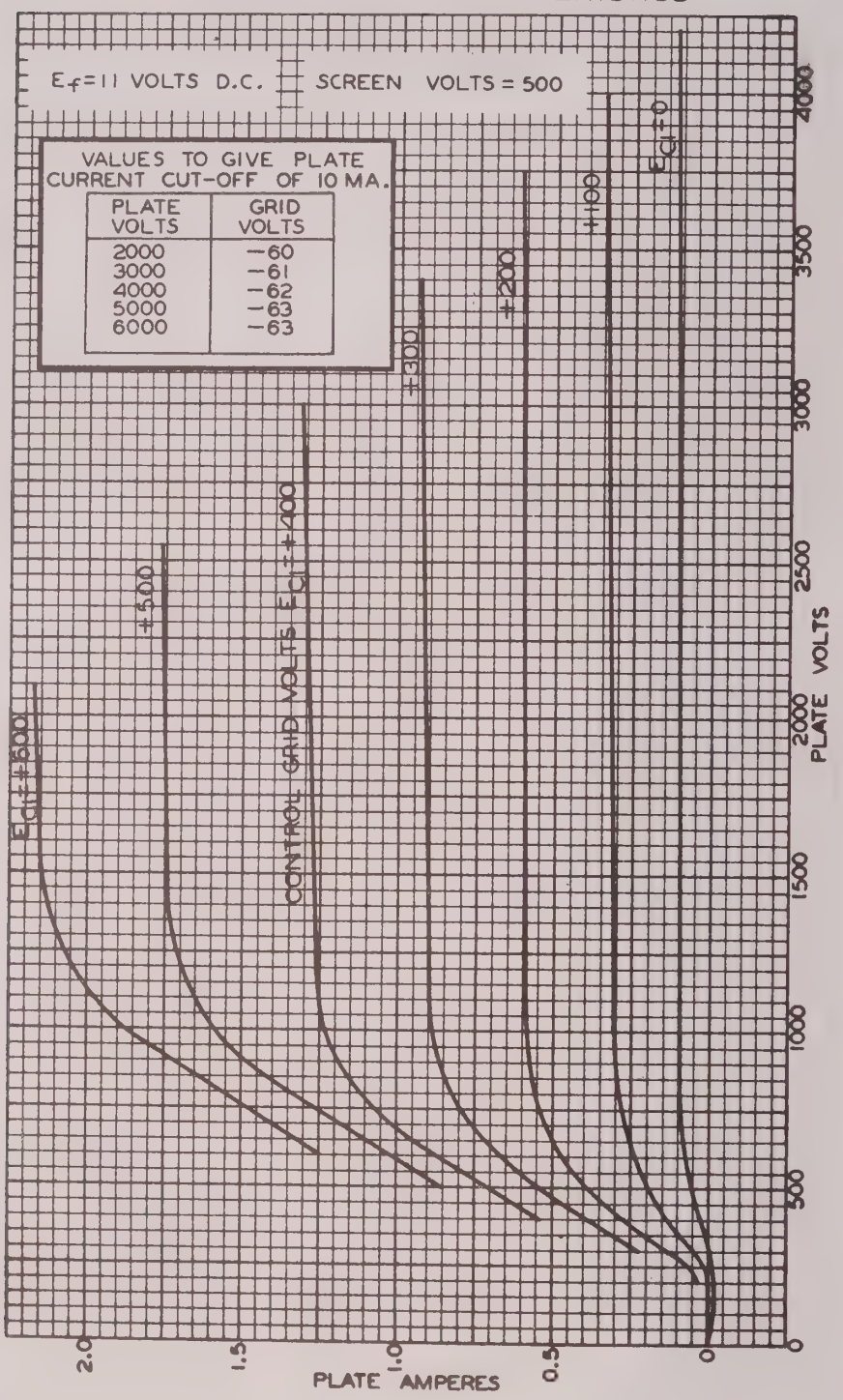



TUBE SYMBOL & CONNECTIONS TO END-MOUNTINGS




NOTE:- SCREEN CONNECTION TO BOTH BLADE AND METAL SIDE CAP

## AVERAGE PLATE CHARACTERISTICS



862

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(WATER & FORCED-AIR COOLED)

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 33 | a-c or d-c volts |
| Current | 207 | amp. |
| Amplification Factor | 48 | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 75 | μμf |
| Grid to Filament | 52 | μμf |
| Plate to Filament | 2 | μμf |
| Maximum Overall Length | | 60-3/8" |
| Maximum Radius | | 8-1/2" |
| Bulb | | T-48 with arms |
| Base(with nozzle for air-cooling of filament seal) | | No. 3908 |
| Water Jacket(with nozzle for air-cooling of bulb) | | UT-1289 |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 20000 max. | volts |
| Plate Dissipation | Averaged over any audio-frequency cycle | 50000 max. | watts |
| Plate Input | | 100000 max. | watts |
| Typical Operation (2 tubes): | | | |
| Filament Voltage | | 33 | a-c volts |
| D-C Plate Voltage | | 12000 | volts |
| Grid Voltage | | -80 approx. | volts |
| Zero-Signal Plate Cur.(per tube) | | 1.0 | amp. |
| Max.-Signal Plate Cur.(per tube) | | 8.5 | amp. |
| Nominal Power Output (2 tubes) | | 100000 | watts |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 20000* max. | volts |
| D-C Plate Current | | | 5.0 max. | amp. |
| Plate Dissipation | | | 100000 max. | watts |
| R-F Grid Current | | | 40 max. | amp. |
| Typical Operation: | | | | |
| Filament Voltage | 33 | 33 | 33 | a-c volts |
| D-C Plate Voltage | 12000 | 15000 | 18000 | volts |
| Grid Voltage | -240 | -270 | -300 | approx. volts |
| D-C Plate Current | 2.8 | 3.5 | 4.2 | amp. |
| Peak Power Output | 45000 | 70000 | 100000 | approx. watts |
| Nominal Carrier P.O. | 11000 | 17500 | 25000 | watts |

* This is the maximum safe plate voltage for this service when the 862 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). When 862's are used in parallel, the plate voltage and output per tube should be decreased and in addition the load should be balanced between tubes.

# 862

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

## PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 12000** max. | volts |
| D-C Plate Current | 5.0 max. | amp. |
| Plate Dissipation | 66000 max. | watts |
| R-F Grid Current | 40 max. | amp. |
| D-C Grid Current | 1.0 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 33 a-c | volts |
| D-C Plate Voltage | 10000 | volts |
| Grid Voltage | -1000 approx. | volts |
| D-C Plate Current | 4.5 | amp. |
| Nominal Power Output | 30000 | watts |

**This is the maximum safe plate voltage for this service when the 862 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). The high a-c peaks encountered when modulating necessitate the use of reduced plate voltage and current as compared with the unmodulated Class C service given below.

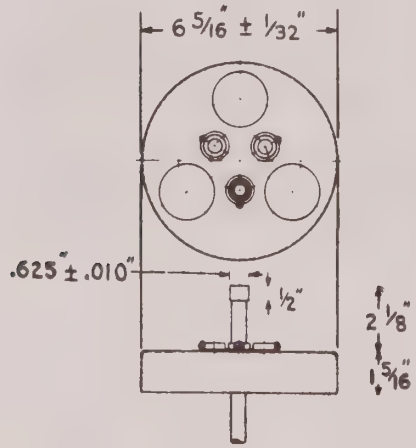
## R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

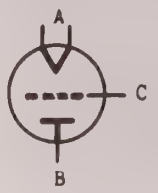
| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 20000° max. | volts |
| D-C Plate Current | | | 10 max. | amp. |
| Plate Dissipation | | | 100000 max. | watts |
| R-F Grid Current | | | 60 max. | amp. |
| D-C Grid Current | | | 1.0 max. | amp. |
| Typical Operation: | | | | |
| Filament Voltage | 33 | 33 | 33 a-c | volts |
| D-C Plate Voltage | 12000 | 15000 | 18000 | volts |
| Grid Voltage | -2700 | -3300 | -4000 approx. | volts |
| D-C Plate Current | 5.6 | 7.0 | 8.4 | amp. |
| Nominal Power Output | 45000 | 75000 | 100000 | watts |

° This is the maximum safe plate voltage for this service when the 862 is used singly and at frequencies below 1500 kc (wavelengths above 200 meters). When 862's are used in parallel, the plate voltage and output per tube should be decreased and in addition the load should be balanced between tubes.

No. 3908 BASE OUTLINE



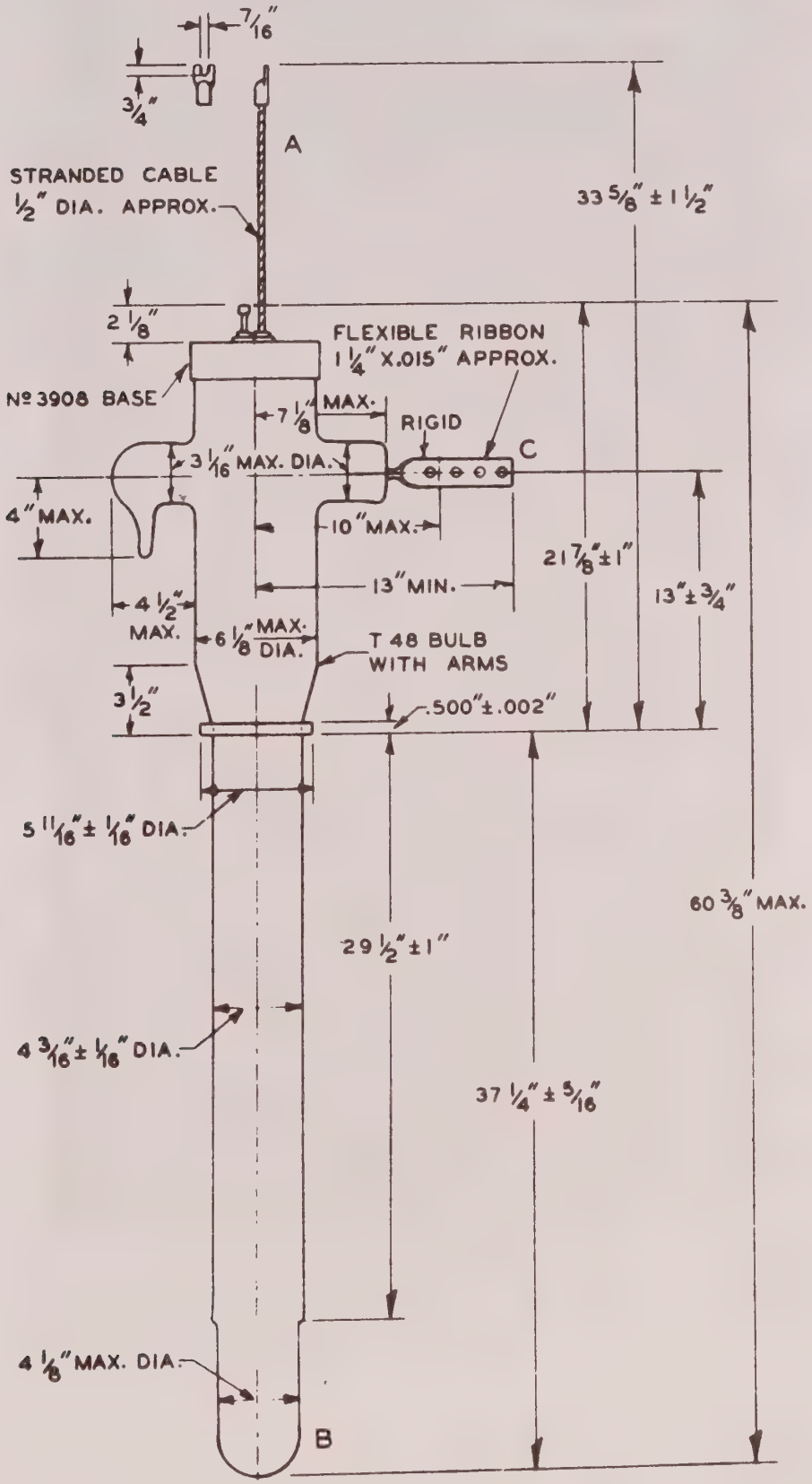

TUBE SYMBOL AND TERMINAL CONNECTIONS




A - Filament
B - Plate
C - Grid

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)



RCA

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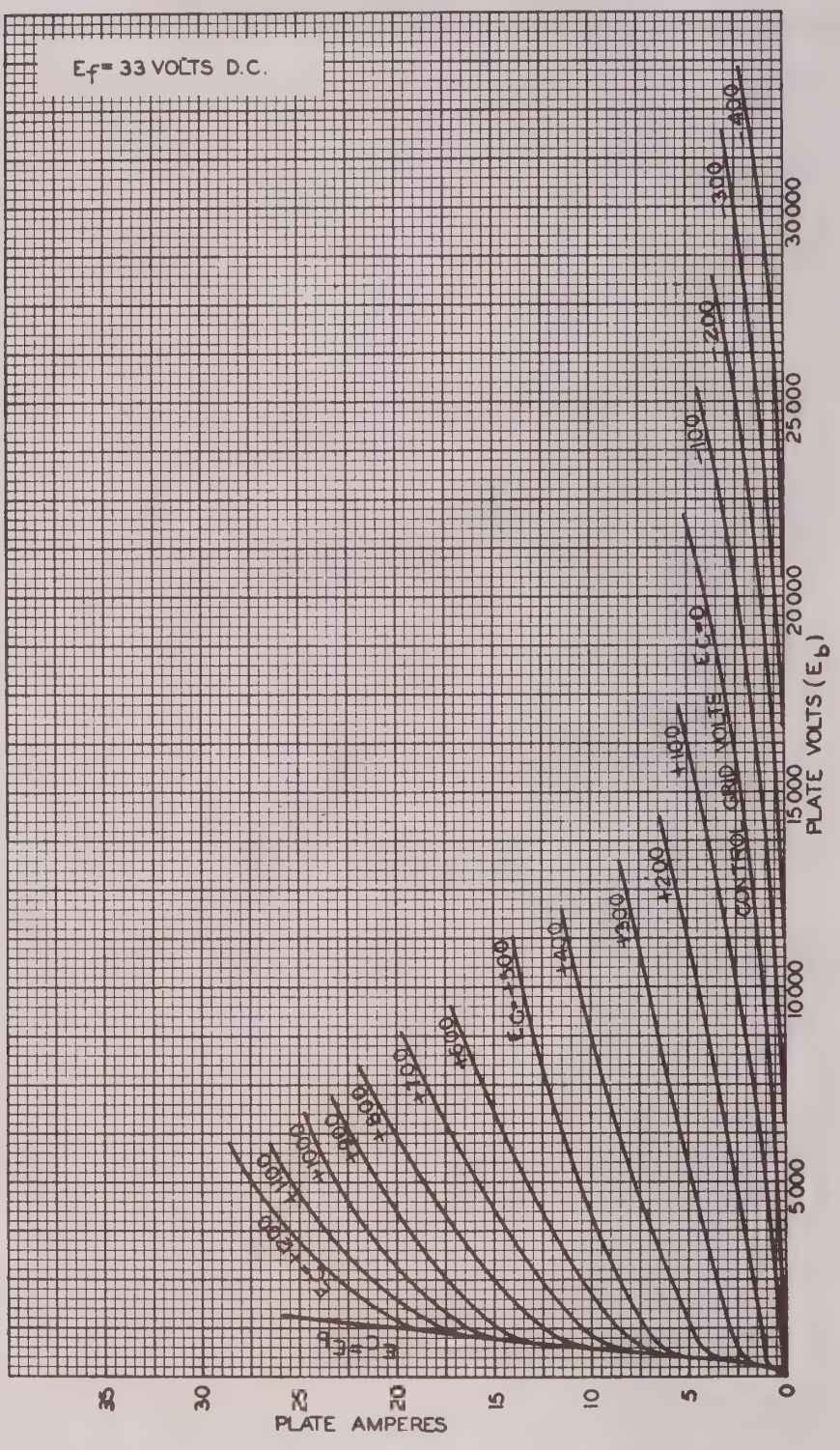
## AVERAGE PLATE CHARACTERISTICS



RCA

# 863

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(WATER COOLED)

| | | |
|---|---|---|
| Filament | Tungsten | |
| Voltage | 22 | a-c or d-c volts |
| Current | 52 | amp. |
| Amplification Factor | 50 | |
| Direct Interelectrode Capacitances (approx.): | | |
| Grid to Plate | 27 | μμf |
| Grid to Filament | 18 | μμf |
| Plate to Filament | 2 | μμf |
| Maximum Overall Length | | 20-1/4" |
| Maximum Radius | | 6-1/2" |
| Bulb | | T-32 with arm |
| Base | | No. 3906 |
| Water Jacket | | UT-1285 |

## A-F POWER AMPLIFIER & MODULATOR - Class B

| | | | |
|---|---|---|---|
| D-C Plate Voltage | Averaged over any audio-frequency cycle | 15000 max. | volts |
| D-C Plate Current | | 2.0 max. | amp. |
| Plate Dissipation | | 10000 max. | watts |
| Plate Input | | 25000 max. | watts |
| Typical Operation (2 tubes): | | | |
| Filament Voltage | | 22 | a-c volts |
| D-C Plate Voltage | | 12000 | volts |
| Grid Voltage | | -210 approx. | volts |
| Zero-Signal Plate Cur.(per tube) | | 0.1 | amp. |
| Max.-Signal Plate Cur.(per tube) | | 1.8 | amp. |
| Power Output (2 tubes) | | 27500 approx. | watts |

For additional TYPICAL OPERATING DATA, see TABLE I on next page.

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | |
|---|---|---|
| D-C Plate Voltage | 15000* max. | volts |
| D-C Plate Current | 1.0 max. | amp. |
| Plate Dissipation | 10000 max. | watts |
| R-F Grid Current | 20 max. | amp. |
| Typical Operation: | | |
| Filament Voltage | 22 | a-c volts |
| D-C Plate Voltage | 13500 | volts |
| Grid Voltage | -245 approx. | volts |
| D-C Plate Current | 0.9 | amp. |
| Peak Power Output | 16000 approx. | watts |
| Carrier Power Output | 4000 approx. | watts |

* This is the maximum safe plate voltage for this service when the 863 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). When 863's are used in parallel or at frequencies above 1500 kc, the plate voltage and output per tube should be decreased, and in addition the load should be balanced between tubes. For operation of the 863 at the higher frequencies, refer to TABLE II on the second following page.

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 10000** | max. | volts |
| D-C Plate Current | 1.0 | max. | amp. |
| Plate Dissipation | 6600 | max. | watts |
| R-F Grid Current | 20 | max. | amp. |
| D-C Grid Current | 0.2 | max. | amp. |
| Typical Operation: | | | |
| Filament Voltage | 22 | a-c | volts |
| D-C Plate Voltage | 9000 | | volts |
| Grid Voltage | -1800 | approx. | volts |
| D-C Plate Current | 1.0 | | amp. |
| Power Output | 6000 | approx. | watts |

** This is the maximum safe plate voltage for this service when the 863 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). The high a-c peaks encountered when modulating necessitate the use of reduced plate voltage and current as compared with the unmodulated Class C service given below. For operation of the 863 at the higher frequencies, refer to TABLE III on next page.

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

*(Key-down Conditions)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | 15000° | max. | volts |
| D-C Plate Current | 2.0 | max. | amp. |
| Plate Dissipation | 10000 | max. | watts |
| R-F Grid Current | 30 | max. | amp. |
| D-C Grid Current | 0.2 | max. | amp. |
| Typical Operation: | | | |
| Filament Voltage | 22 | a-c | volts |
| D-C Plate Voltage | 13200 | | volts |
| Grid Voltage | -2500 | approx. | volts |
| D-C Plate Current | 1.8 | | amp. |
| Power Output | 15000 | approx. | watts |

° This is the maximum safe plate voltage for this service when the 863 is used singly and at frequencies below 1500 kc ( wavelengths above 200 meters). When 863's are operated in parallel or at frequencies above 1500 kc, the plate voltage and output per tube should be decreased, and in addition the load should be balanced between tubes. For operation of the 863 at the higher frequencies refer to TABLE IV on next page.

TABLE I

*Typical Class B Audio-Frequency Operation (2 tubes)*

| D-C PLATE VOLTS | APPROX. GRID BIAS VOLTS | ZERO-SIGNAL PLATE AMPERES (per tube) | MAX.-SIGNAL PLATE AMPERES (per tube) | APPROX. WATTS OUTPUT (2 tubes) |
|---|---|---|---|---|
| 15000 | -270 | 0.1 | 1.6 | 30400 |
| 13500 | -235 | 0.1 | 1.8 | 30800 |
| 12000 | -200 | 0.1 | 1.8 | 27500 |
| 10500 | -170 | 0.1 | 1.65 | 22000 |
| 9000 | -140 | 0.1 | 1.5 | 17200 |

# OSCILLATOR, R-F POWER AMPLIFIER, CLASS B MODULATOR

(continued from preceding page)

TABLE II

*Carrier Conditions; for use with a Modulation Factor up to 1.0*

| FREQUENCY kc | MAX. D-C PLATE VOLTS | APPROX. GRID BIAS VOLTS | TYPICAL VALUES OF D-C PLATE AMP. | PLATE DISSIPATION WATTS | PEAK OUTPUT WATTS | CARRIER OUTPUT WATTS |
|---|---|---|---|---|---|---|
| 1500 | 15000 | -340 | 1.00 | 10000 | 20000 | 5000 |
| 2500 | 14100 | -320 | 0.97 | 9000 | 18000 | 4500 |
| 3750 | 13200 | -300 | 0.93 | 8300 | 16000 | 4000 |
| 7500 | 11400 | -260 | 0.83 | 6400 | 12000 | 3000 |
| 15000 | 8900 | -200 | 0.65 | 4100 | 7000 | 1700 |
| 20000 | 7500 | -170 | 0.59 | 3200 | 5000 | 1200 |

TABLE III

*Carrier Conditions; for use with a Modulation Factor up to 1.0*

| FREQUENCY kc | MAX. D-C PLATE VOLTS | APPROX. GRID BIAS VOLTS | TYPICAL VALUES OF D-C PLATE AMPERES | POWER OUTPUT WATTS |
|---|---|---|---|---|
| 1500 | 10000 | -2000 | 1.0 | 6600 |
| 3200 | 9000 | -1800 | 1.0 | 6000 |
| 6000 | 8000 | -1600 | 1.0 | 5200 |
| 9600 | 7000 | -1500 | 1.0 | 4500 |
| 14400 | 6000 | -1400 | 0.9 | 3700 |
| 20000 | 5000 | -1300 | 0.8 | 3000 |

TABLE IV

*(Key-down Conditions)*

| FREQUENCY kc | MAX. D-C PLATE VOLTS | APPROX. GRID BIAS VOLTS | TYPICAL VALUES OF D-C PLATE AMPERES | POWER OUTPUT WATTS |
|---|---|---|---|---|
| 1500 | 15000 | -2700 | 2.0 | 20000 |
| 2500 | 14100 | -2600 | 1.9 | 18000 |
| 3750 | 13200 | -2500 | 1.8 | 15000 |
| 7500 | 11400 | -2200 | 1.7 | 12000 |
| 15000 | 8900 | -1800 | 1.4 | 7500 |
| 20000 | 7500 | -1600 | 1.3 | 5500 |

OUTLINE DIMENSIONS, TUBE SYMBOL, and TERMINAL CONNECTIONS for the 863 are the same as for the 207.

RCA

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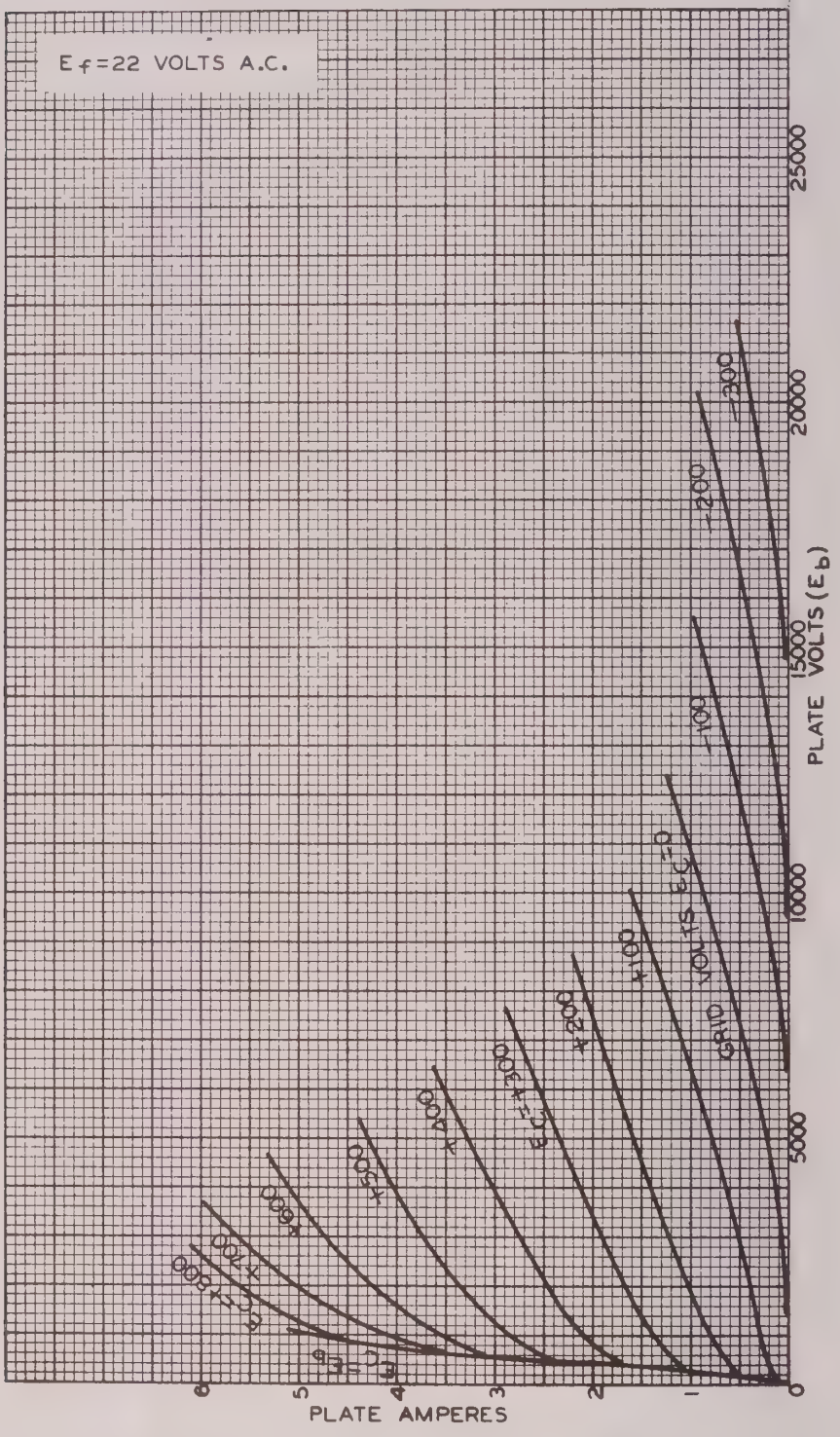
## AVERAGE PLATE CHARACTERISTICS



# 864

# AMPLIFIER
(LOW MICROPHONIC DESIGN)

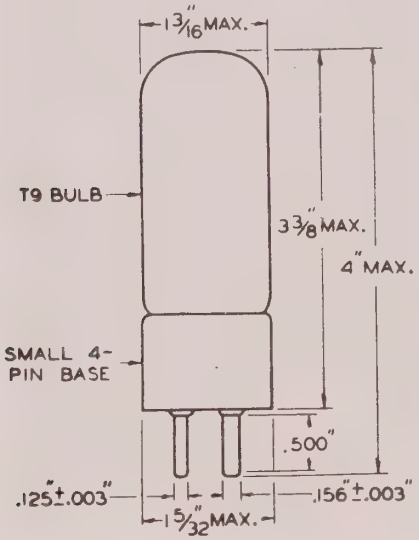
| | | | |
|---|---|---|---|
| Filament | Coated | | |
| Voltage | 1.1 | | d-c volts |
| Current | 0.25 | | amp. |
| Direct Interelectrode Capacitances: | | | |
| Grid to Plate | 5.3 | µµf | |
| Grid to Filament | 3.3 | µµf | |
| Plate to Filament | 2.1 | µµf | |
| Maximum Overall Length | | | 4" |
| Maximum Diameter | | | 1-3/16" |
| Bulb | | | T-9 |
| Base | | | Small 4-Pin |

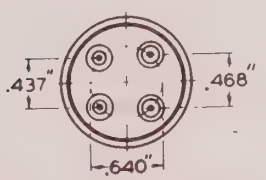
AMPLIFIER - Class A

Operating Conditions and Characteristics:

| | | | | |
|---|---|---|---|---|
| Filament Voltage | 1.1 | 1.1 | d-c | volts |
| Plate Voltage | 90 | 135 | max. | volts |
| Grid Voltage | -4.5 | -9 | | volts |
| Amplification Factor | 8.2 | 8.2 | | |
| Plate Resistance | 13500 | 12700 | | ohms |
| Mutual Conductance | 610 | 645 | | µmhos |
| Plate Current | 2.9 | 3.5 | | ma. |

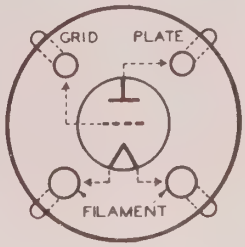
If a grid-coupling resistor is used, its maximum value should not exceed 2.0 megohms.




BOTTOM VIEW OF BASE

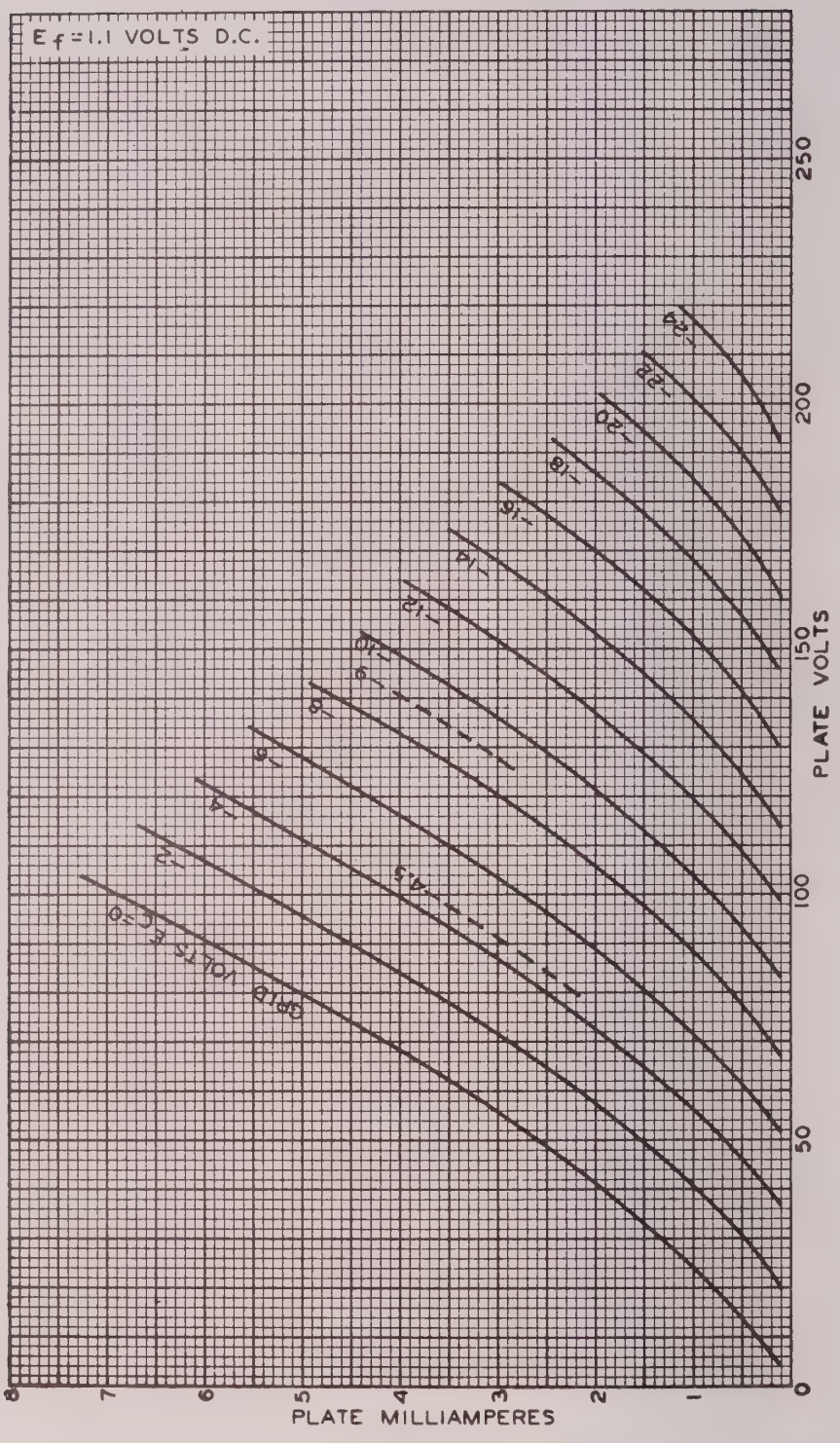
TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS



RCA

# 864

## AVERAGE PLATE CHARACTERISTICS



# 866

# HALF-WAVE MERCURY-VAPOR RECTIFIER

| | | |
|---|---|---|
| Filament* | Coated | |
| Voltage | 2.5 | a-c volts |
| Current | 5.0 | amp. |
| Maximum Overall Length | | 6-5/8" |
| Maximum Diameter | | 2-7/16" |
| Bulb | | S-19 |
| Cap | | Medium Metal |
| Base | | Medium 4-Pin Bayonet |

Peak Inverse Voltage:

| *Supply Freq.* | *Ambient Temp. Range* | |
|---|---|---|
| Up to 150~ | 0° - 50°C | 7500 max. volts |
| Peak Plate Current | | 0.6 max. amp. |
| Tube Voltage Drop | | 15 approx. volts |

* The filament of the 866 should be allowed to come up to operating temperature before plate voltage is applied. For average conditions, the delay is approximately 30 seconds.

For *shielding and r-f filter circuits*, refer to Type 871.

The table on the next page gives empirical values of choke inductance (L) and condenser capacity (C) for choke-input-to-filter circuits which will keep the peak plate current below the recommended maximum, provided the average d-c load current does not exceed the maximum load-current values shown. Values of (L) and (C) are based on a 60-cycle a-c voltage supply.

The capacitance (C) is small enough to prevent excessive surges when power is first applied to the circuit, and yet large enough to give adequate filtering. If the inductance (L) is increased, it is permissible to increase the capacitance in the same proportion. In a two-section filter with two inductances of unequal value, the larger inductance should be placed next to the rectifier tubes. With such an arrangement, the maximum value of each capacitance should be determined on the basis of the value of the inductance preceding it.

The circuits of FIGS. 1, 2, and 3 will give a ripple voltage of less than 5% when used with a two-section filter having the minimum of inductance and the corresponding maximum of capacitance. The circuits of FIGS. 4 and 5 will give a ripple voltage of less than 1%. For any of these circuits, better filtering may be obtained with the inductances larger than the minimum given in the table. For these larger inductances, the corresponding capacitances may be increased by the same percentage as the inductances to give still better results. For example, with a 100% increase in the inductance (L) next to the rectifier tubes, the d-c load current may be increased 50%. A 200% increase permits an increase of 67% in load current.

# 866

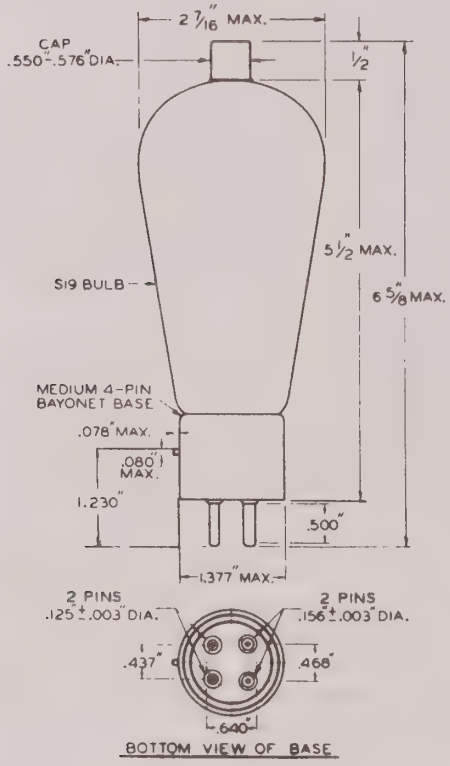
# HALF-WAVE MERCURY-VAPOR RECTIFIER

(continued from preceding page)

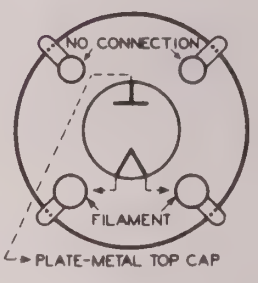
*For Circuits, refer to page following Type 857.*

| CIRCUIT | A-C INPUT VOLTS (RMS) | MAX. D-C OUTPUT VOLTS TO FILTER | CHOKE INPUT ONE-SECTION FILTER | | MAX. D-C LOAD CURRENT |
|---|---|---|---|---|---|
| | | | MIN. CHOKE (L) henrys | MAX. CONDENSER (C) μf | amperes |
| SINGLE-PHASE FULL-WAVE (2 tubes) FIG. 1 | 2650 per tube | 2385 | 10.0 | 1.0 | 0.3 |
| | 2000 " " | 1800 | 8.3 | 1.1 | 0.3 |
| | 1500 " " | 1350 | 5.6 | 1.7 | 0.3 |
| | 1000 " " | 900 | 3.7 | 2.6 | 0.3 |
| SINGLE-PHASE FULL-WAVE (4 tubes) FIG. 2 | 5300 total | 4770 | 20.0 | 0.5 | 0.3 |
| | 4500 " | 4050 | 16.9 | 0.6 | 0.3 |
| | 4000 " | 3600 | 15.0 | 0.7 | 0.3 |
| | 3000 " | 2700 | 11.3 | 0.8 | 0.3 |
| THREE-PHASE HALF-WAVE FIG. 3 | 3065 per leg | 3585 | 3.7 | 1.1 | 0.3 |
| | 2500 " " | 2925 | 3.0 | 1.4 | 0.3 |
| | 2000 " " | 2340 | 2.4 | 1.8 | 0.3 |
| | 1500 " " | 1755 | 1.8 | 2.4 | 0.3 |
| THREE-PHASE DOUBLE-Y PARALLEL FIG. 4 | 3065 per leg | 3585 | 1.8 | 0.6 | 1.2 |
| | 2500 " " | 2925 | 1.5 | 0.7 | 1.2 |
| | 2000 " " | 2340 | 1.2 | 0.9 | 1.2 |
| | 1500 " " | 1755 | 0.9 | 1.2 | 1.2 |
| THREE-PHASE FULL-WAVE FIG. 5 | 3065 per leg | 7175 | 2.5 | 0.5 | 0.6 |
| | 2500 " " | 5850 | 2.0 | 0.5 | 0.6 |
| | 2000 " " | 4680 | 1.7 | 0.6 | 0.6 |
| | 1500 " " | 3510 | 1.3 | 0.8 | 0.6 |
| SINGLE-PHASE FULL-WAVE (2 tubes) FIG. 1* | 2650 per tube | 3000 | - | - | 0.165 |
| | 2000 " " | 2260 | - | - | 0.165 |
| | 1500 " " | 1700 | - | - | 0.165 |
| | 1000 " " | 1150 | - | - | 0.165 |

* With condenser input to filter.




TUBE SYMBOL & TOP VIEW OF SOCKET CONNECTIONS



RCA

# 869-A

# HALF-WAVE MERCURY-VAPOR RECTIFIER

| | | |
|---|---|---|
| Filament* | Coated | |
| Voltage | 5 | a-c volts |
| Current | 18 | amp. |
| Overall Length | | 14-1/4"±1/8" |
| Maximum Diameter | | 5-1/16" |
| Bulb | | GT-40 |
| Cap | | No. 3905 |
| Base# | | No. 3502 |

Peak Inverse Voltage:

| *Supply Freq.* | *Ambient Temp. Range* | |
|---|---|---|
| Up to 150~ | 15° - 50°C | 20000 max. volts |
| Peak Plate Current | | 10 max. amp. |
| Average Plate Current | | 2.5 max. amp. |
| Tube Voltage Drop | | 10 approx. volts |

* The filament of the 869-A should be allowed to come up to operating temperature before plate voltage is applied. For average conditions the delay is approximately 60 seconds.

\# Base shell is not connected to either filament lead within base.

For *shielding and r-f filter circuits,* refer to Type 871.

The table below classifies suitable rectifier circuits for the 869-A and shows their safe maximum input and maximum output operating conditions. The values are based on sine-wave input and the use of a pure resistance load.

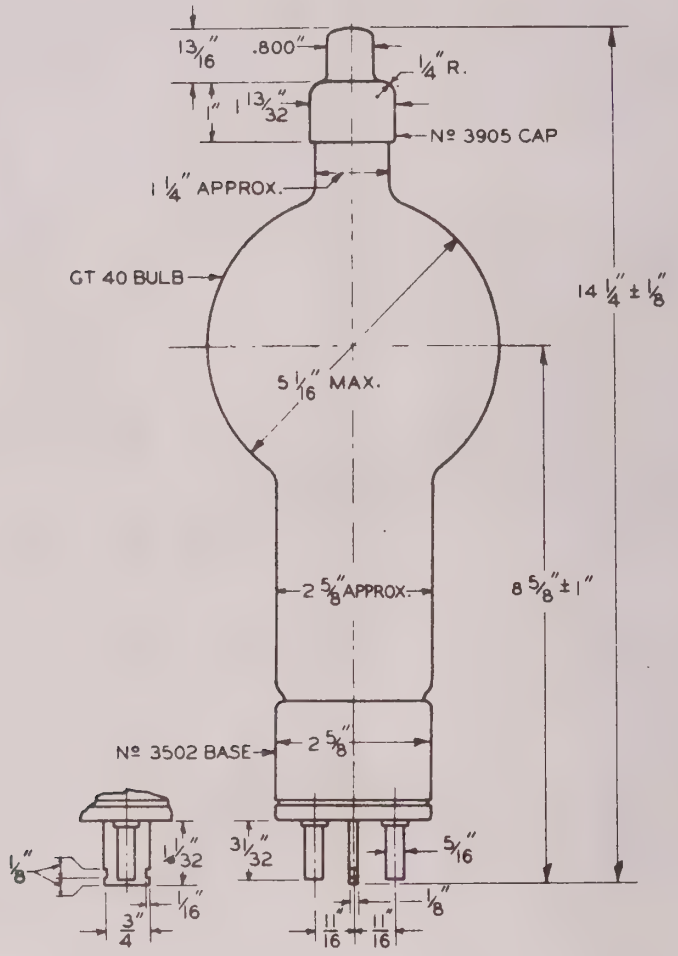
*For Circuits, refer to page following Type 857.*

| CIRCUIT | MAXIMUM A-C INPUT VOLTS (RMS) | APPROX. D-C OUTPUT VOLTS TO FILTER | MAXIMUM D-C LOAD CURRENT amperes |
|---|---|---|---|
| SINGLE-PHASE FULL-WAVE (2 tubes) FIG. 1 | 7000 per tube | 6300 | 5.0 |
| SINGLE-PHASE FULL-WAVE (4 tubes) FIG. 2 | 14000 total | 12600 | 5.0 |
| THREE-PHASE HALF-WAVE FIG. 3 | 8250 per leg | 9600 | 7.5 |
| THREE-PHASE DOUBLE-Y PARALLEL FIG. 4 | 8250 per leg | 9600 | 15.0 |
| THREE-PHASE FULL-WAVE FIG. 5 | 8250 per leg | 19200 | 7.5 |

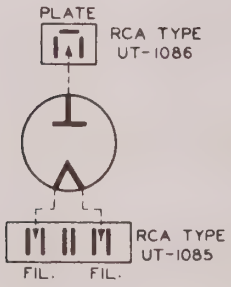
# 869-A

# HALF-WAVE MERCURY-VAPOR RECTIFIER

(continued from preceding page)




TUBE SYMBOL & CONNECTIONS
TO END-MOUNTINGS



RCA

# 870

# HALF-WAVE MERCURY-VAPOR RECTIFIER

(FORCED-AIR COOLED)

| | | |
|---|---|---|
| Heater | Coated Uni-potential Cathode* | |
| Voltage | 5 | a-c volts |
| Current | 65 | amp. |
| Overall Length | | 25" ± 1/2" |
| Maximum Diameter | | 10-1/4" |
| Bulb | | GT-80 |
| Base# | | No. 3914 |

Peak Inverse Voltage:

| *Supply Freq.* | *Condensed Mercury Temp. Range* | |
|---|---|---|
| Up to 150~ | 35° - 50°C | 7500 max. volts |
| Up to 150~ | 35° - 40°C | 16000 max. volts |
| Peak Plate Current | | 450 max. amp. |
| Average Plate Current | Averaged over period of 60 sec. | 75 max. amp. |
| Tube Voltage Drop | | 10 approx. volts |

* The cathode should be allowed to come up to operating temperature and the mercury vapor to reach operating pressure before plate voltage is applied. For average conditions, the delay is about 30 minutes depending on the amount and the controlled temperature of the cooling air as well as on the heater-supply transformer characteristics.

  The heater-supply transformer should be capable of delivering approximately 400 watts at 5 volts and should maintain this voltage within plus or minus 5%.

# Base shell is connected within base to cathode lead.

For *shielding and r-f filter circuits*, refer to Type 871.

The table below classifies suitable rectifier circuits for the 870 and shows their safe maximum input and maximum output operating conditions for a peak inverse voltage of 16000 volts. The values are based on sine-wave input and the use of a pure resistance load. If the 870 is to be used under temperature conditions such that the peak inverse voltage is limited to 7500 volts, the a-c input voltage and d-c output voltage values in the table should be multiplied by a factor of 0.47 to give the maximum values for the 7500-volt conditions.

*For Circuits, refer to page following Type 857.*

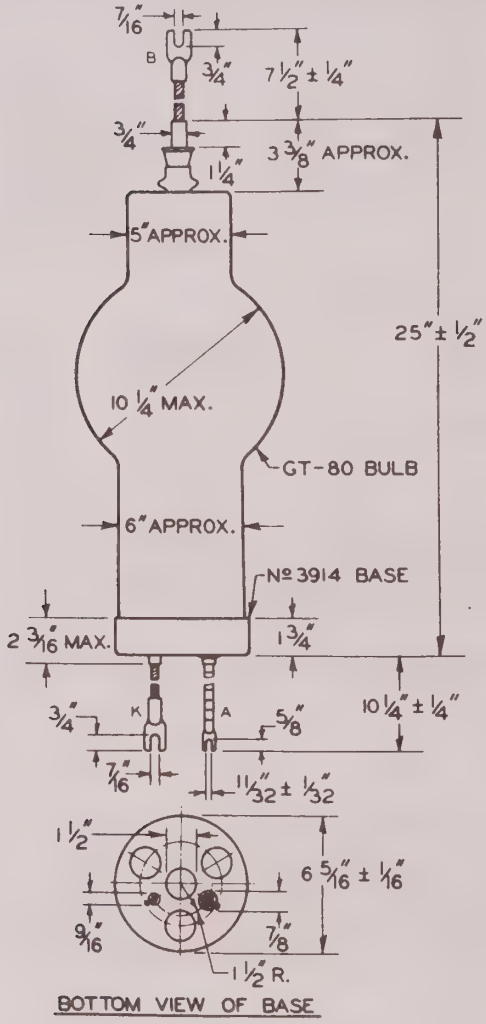
| CIRCUIT | MAXIMUM A-C INPUT VOLTS* (RMS) | APPROX. D-C OUTPUT VOLTS TO FILTER | MAXIMUM D-C LOAD CURRENT amperes |
|---|---|---|---|
| SINGLE-PHASE FULL-WAVE (2 tubes) FIG.1 | 5650 per tube | 5100 | 150 |
| SINGLE-PHASE FULL-WAVE (4 tubes) FIG.2 | 11300 total | 10200 | 150 |
| THREE-PHASE HALF-WAVE FIG.3 | 6540 per leg | 7650 | 225 |
| THREE-PHASE DOUBLE-Y PARALLEL FIG.4 | 6540 per leg | 7650 | 450 |
| THREE-PHASE FULL-WAVE FIG.5 | 6540 per leg | 15300 | 225 |

* For maximum peak inverse voltage of 16000 volts.

# 870

# HALF-WAVE MERCURY-VAPOR RECTIFIER

(continued from preceding page)




BOTTOM VIEW OF BASE

TUBE SYMBOL
AND
TERMINAL CONNECTIONS

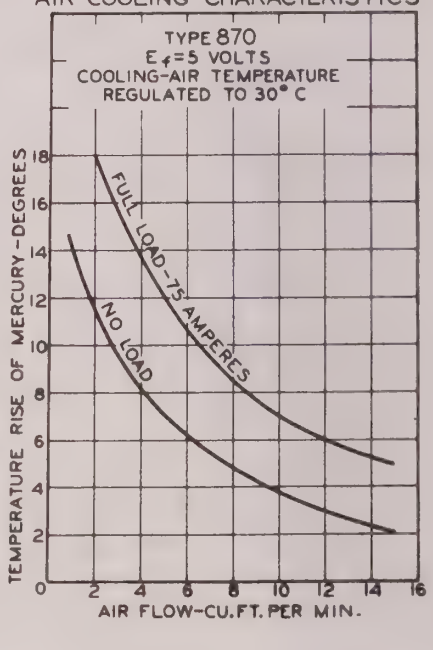
A - Heater
K - Cathode & Heater
B - Plate

NOTE: Special end-mountings are required.

NOTE ON
AIR-COOLING CURVES

COOLING AIR REGULATED TO TEMPERATURE OF 30°C AND DIRECTED HORIZONTALLY FROM A 1" TO 1-1/2" DIAMETER NOZZLE LOCATED 1/2" ABOVE CATHODE BASE.

AIR-COOLING CHARACTERISTICS



RCA

871

# HALF-WAVE MERCURY-VAPOR RECTIFIER

| | | |
|---|---|---|
| Filament* | Coated | |
| Voltage | 2.5 | a-c volts |
| Current | 2.0 | amp. |
| Maximum Overall Length | | 4-1/2" |
| Maximum Diameter | | 1-3/16" |
| Bulb | | T-9 |
| Cap | | Medium Metal |
| Base | | Small 4-Pin |
| Peak Inverse Voltage: | | |
| *Supply Freq.* | *Ambient Temp. Range* | |
| Up to 150~ | 0° - 50°C | 5000 max. volts |
| Peak Plate Current | | 0.3 max. amp. |
| Tube Voltage Drop | | 15 approx. volts |

* The filament of the 871 should be allowed to come up to operating temperature before plate voltage is applied. For average conditions, the delay is approximately 10 seconds.

*Shielding and r-f filter circuits* should be provided for the 871 if it is subjected during operation to high-voltage high-frequency fields. These fields tend to produce breakdown effects in mercury vapor and are detrimental to tube life and performance. External shielding is employed when the tube is in proximity to high-voltage, high-frequency fields. R-F filters are employed to prevent damage caused by radio-frequency currents which might otherwise be fed back into the rectifier tubes.

The table below classifies suitable rectifier circuits for the 871 and shows their safe maximum input and maximum output operating conditions. The values are based on sine-wave input and the use of a pure resistance load.

*For Circuits, refer to page following Type 857.*

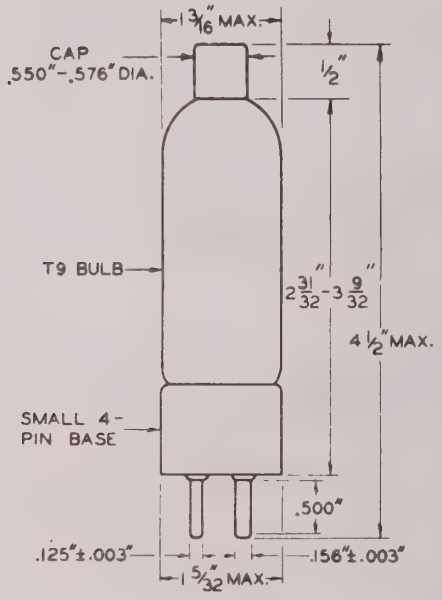
| CIRCUIT | MAXIMUM A-C INPUT VOLTS (RMS) | APPROX. D-C OUTPUT VOLTS TO FILTER | MAXIMUM D-C LOAD CURRENT amperes |
|---|---|---|---|
| SINGLE-PHASE FULL-WAVE (2 tubes) FIG.1 | 1750 per tube | 1570 | 0.20 |
| SINGLE-PHASE FULL-WAVE (4 tubes) FIG.2 | 3500 total | 3150 | 0.20 |
| THREE-PHASE HALF-WAVE FIG.3 | 2050 per leg | 2400 | 0.25 |
| THREE-PHASE DOUBLE-Y PARALLEL FIG.4 | 2050 per leg | 2400 | 0.60 |
| THREE-PHASE FULL-WAVE FIG.5 | 2050 per leg | 4800 | 0.30 |

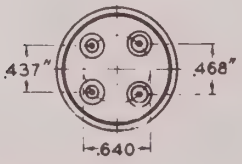
RCA

871

# HALF-WAVE MERCURY-VAPOR RECTIFIER

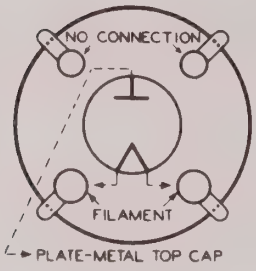
(continued from preceding page)



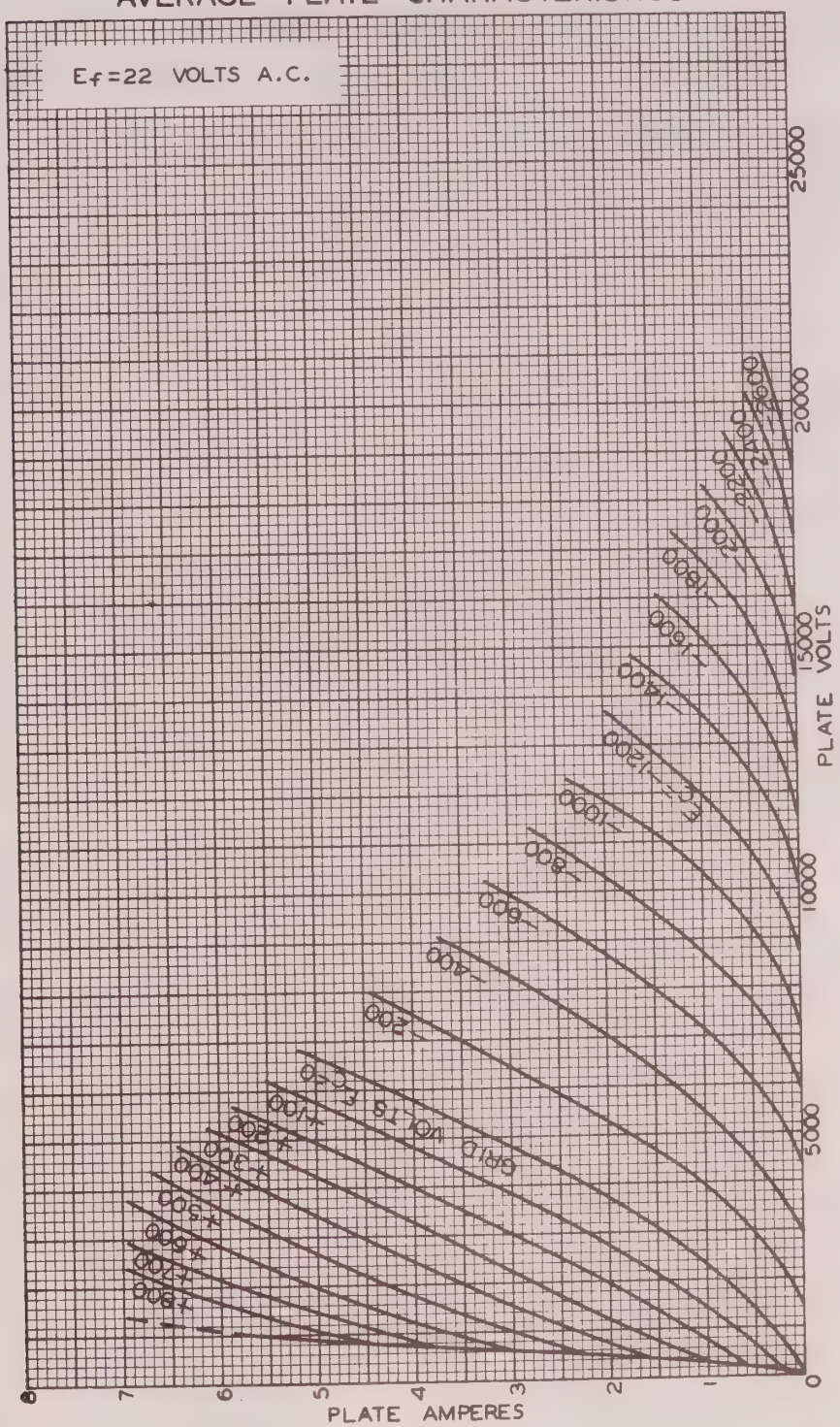




BOTTOM VIEW OF BASE

TUBE SYMBOL & TOP VIEW
OF
SOCKET CONNECTIONS



# AVERAGE PLATE CHARACTERISTICS



RCA

# 850

# SCREEN GRID R-F POWER AMPLIFIER

| | | |
|---|---|---|
| Filament | Thoriated Tungsten | |
| Voltage | 10 | a-c or d-c volts |
| Current | 3.25 | amp. |
| Amplification Factor | 550 approx. | |
| Mutual Conductance for plate current of 19.5 ma. | 2750 μmhos | |
| Direct Interelectrode Capacitances: | | |
| Grid to Plate | 0.25 maximum | μμf |
| Input | 17 | μμf |
| Output | 25 | μμf |
| Maximum Overall Length | | 8-1/2" |
| Maximum Diameter | | 2-5/16" |
| Bulb | | T-18 |
| Cap | | Medium Metal |
| Base | | Jumbo 4-Large Pin |

## R-F POWER AMPLIFIER - Class B (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 1250 max. | volts |
| D-C Plate Current | | 150 max. | ma. |
| Plate Dissipation | | 100 max. | watts |
| Screen Dissipation | | 10 max. | watts |
| R-F Grid Current | | 6 max. | amp. |
| Typical Operation: | | | |
| Filament Voltage | 10 | 10 | a-c volts |
| D-C Plate Voltage | 1000 | 1250 | volts |
| Screen Voltage | 175 | 175 | approx.volts |
| Grid Voltage | -13 | -13 | approx.volts |
| D-C Plate Current | 100 | 110 | ma. |
| Peak Power Output | 120 | 160 | approx.watts |
| Carrier Power Output | 30 | 40 | approx.watts |

## PLATE-MODULATED R-F POWER AMPLIFIER - Class C (Telephony)

*(Carrier Conditions; for use with a Modulation Factor up to 1.0)*

| | | | |
|---|---|---|---|
| D-C Plate Voltage | | 1000 max. | volts |
| D-C Plate Current | | 150 max. | ma. |
| Plate Dissipation | | 70 max. | watts |
| Screen Dissipation | | 7 max. | watts |
| R-F Grid Current | | 6 max. | amp. |
| D-C Grid Current | | 40 max. | ma. |
| Typical Operation: | | | |
| Filament Voltage | 10 | 10 | a-c volts |
| D-C Plate Voltage | 750 | 1000 | volts |
| Screen Voltage | 125 | 140 | approx.volts |
| Grid Voltage | -100 | -100 | approx.volts |
| D-C Plate Current | 140 | 125 | ma. |
| Power Output | 50 | 65 | approx.watts |

# 850

# SCREEN GRID R-F POWER AMPLIFIER

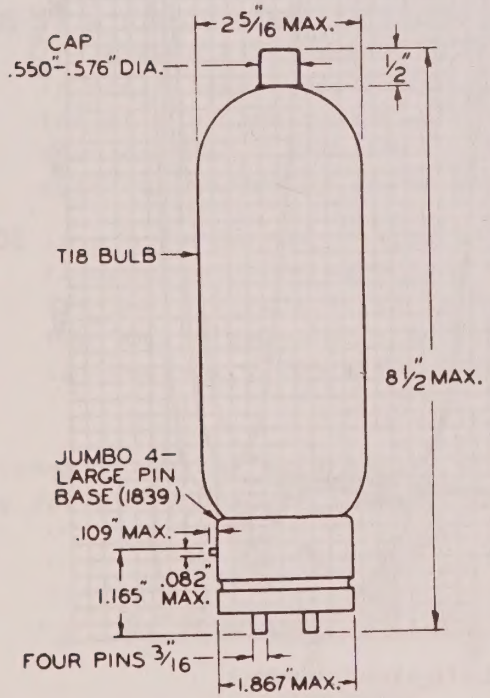
(continued from preceding page)

R-F POWER AMPLIFIER & OSCILLATOR - Class C (Telegraphy)

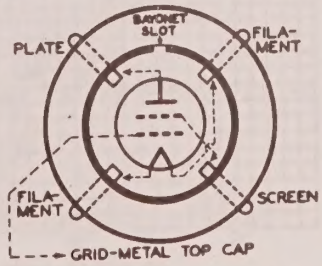
*(Key-down Conditions)*

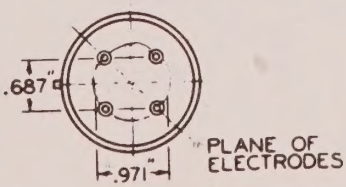
| | | | | |
|---|---|---|---|---|
| D-C Plate Voltage | | | 1250 max. | volts |
| D-C Plate Current | | | 175 max. | ma. |
| Plate Dissipation | | | 100 max. | watts |
| Screen Dissipation | | | 10 max. | watts |
| R-F Grid Current | | | 7.5 max. | amp. |
| D-C Grid Current | | | 40 max. | ma. |
| Typical Operation: | | | | |
| Filament Voltage | 10 | 10 | 10 | a-c volts |
| D-C Plate Voltage | 750 | 1000 | 1250 | volts |
| Screen Voltage | 175 | 175 | 175 | approx. volts |
| Grid Voltage | -150 | -150 | -150 | approx. volts |
| D-C Plate Current | 160 | 160 | 160 | ma. |
| Power Output | 55 | 100 | 130 | approx. watts |

**NOTE:** Regardless of the type of service in which the 850 is used, the maximum ratings apply only for operation at frequencies below approximately 13 megacycles ( wavelengths above 23.5 meters ). For operation at higher frequencies, refer to the sheet on TRANSMITTING TUBE RATINGS vs. OPERATING FREQUENCY.



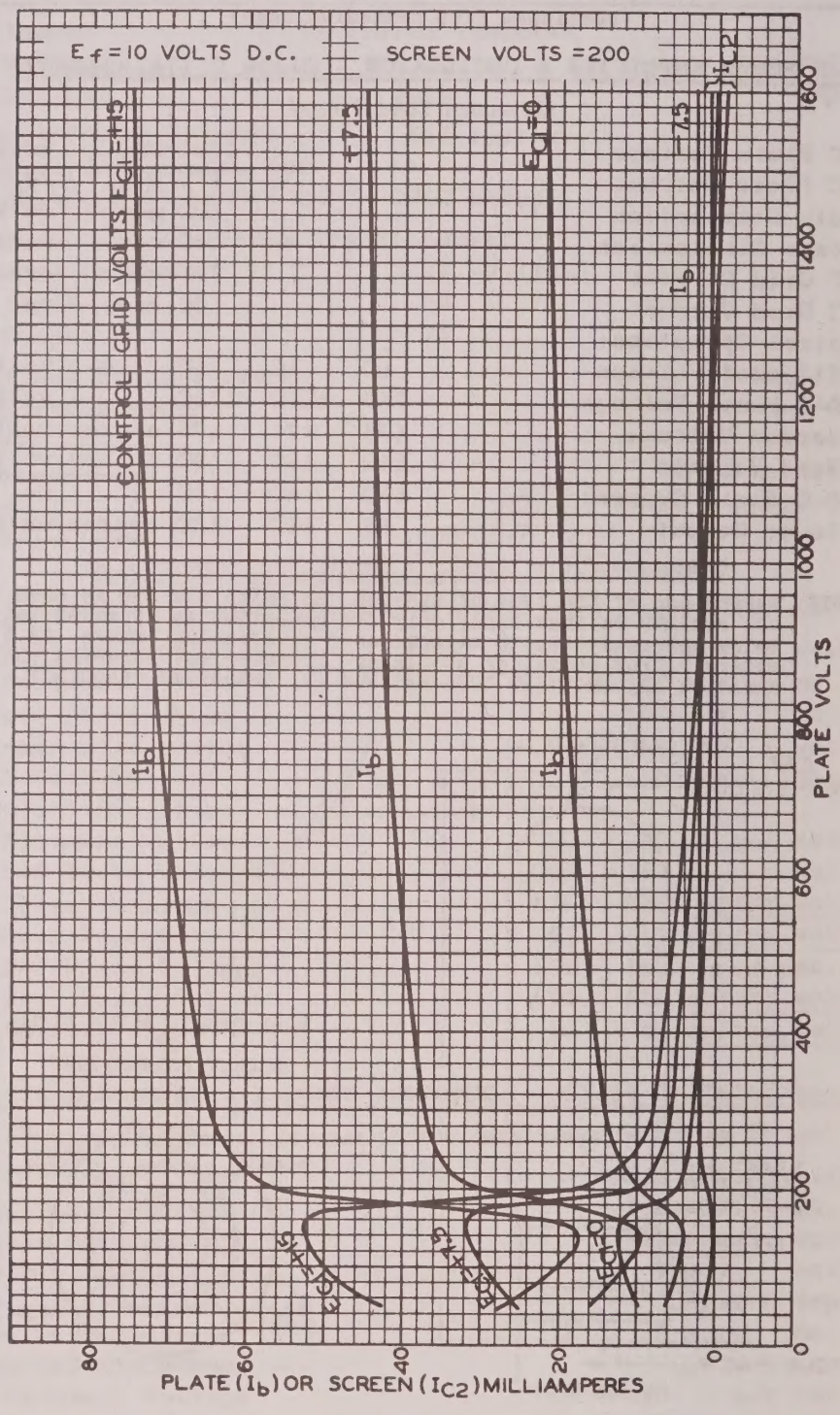

TUBE SYMBOL & TOP VIEW
OF
SOCKET CONNECTIONS




BOTTOM VIEW OF BASE

## AVERAGE PLATE CHARACTERISTICS



## ADDITIONAL RCA RADIOTRONS FOR BROADCAST STATIONS

**RCA-878** is a high-vacuum, half-wave rectifier tube of the hot-cathode type for use in suitable devices to supply the d-c voltage requirements of cathode-ray tubes. Filament volts, 2.5 . Maximum peak inverse volts, 20000. Maximum peak plate current, 20 milliamperes.

**RCA-885** is a grid-controlled, gaseous-discharge tube of the heater-cathode type. It is designed for use as a sweep-circuit oscillator in cathode-ray tube circuits. Heater volts, 2.5 . Maximum peak plate volts, 200. Maximum peak plate current, 300 milliamperes.

**RCA-903** is a high-vacuum, electromagnetic, cathode-ray tube with a fluorescent viewing screen nine inches in diameter. It is recommended for use in oscillograph applications where the inertialess characteristic of the electron beam, the large viewing screen, and the brilliant image all contribute to an accurate and vivid pattern of the phenomena under observation.

**RCA-904** is a high-vacuum, cathode-ray tube with a fluorescent viewing screen five inches in diameter. It is recommended for use in oscillograph applications where the inertialess characteristic of the electron beam, the provision for electrostatic and/or electromagnetic beam control, and the brilliant image all contribute to the general utility of this type for the observation of phenomena.

**RCA-905** is a high-vacuum, cathode-ray tube with a fluorescent viewing screen five inches in diameter. It is recommended for use in oscillograph applications where the inertialess characteristic of the electron beam, double electrostatic deflection control, and a brilliant image of the phenomena under observation are of prime importance.

**RCA-906** is a high-vacuum, electrostatic, cathode-ray tube with a fluorescent viewing screen three inches in diameter. Due to its small size and its ability to produce a brilliant image, the 906 is especially suited for use in oscillograph applications where compactness is a requirement.

*Additional technical information on all types of Transmitting Radiotrons for any broadcast applications may be obtained by writing to*


**RCA RADIOTRON COMPANY, INC.**

HARRISON NEW JERSEY

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